SCIENCE.

FRIDAY, DECEMBER 14, 1883.

THE SIGNAL-SERVICE AND STANDARD TIME.

It has been announced that the chief signal-officer has ordered his corps of observers to continue to be governed by the local time of their respective stations. It is difficult to understand this action on the part of Gen. Hazen. It would seem, that, next to the transportation companies, the weather bureau would be most benefited by the adoption of a system of time which would render all observations strictly and easily comparable with each other. The position taken by the service is all the more remarkable, when it is remembered that only two or three years ago its chief was himself a warm advocate of the new scheme, and declared his anxiety to further its introduction in every way in his power. It will be everywhere admitted that the adoption of standard time by all observers would greatly aid in securing its acceptance by the people generally; and it is to be hoped that it will be shortly done, unless some grave reason, which is certainly not apparent, exists for its rejection.

A SUGGESTION TO AUTHORS.

Authors who republish in a separate form papers originally printed in society transactions or journals should be careful to preserve the original pagination of the serial from which they are extracted, or to indicate the same in some clear way for purposes of ready and correct reference. It would really be worth calling a convention of our scientific societies for the purpose, if a reform could be effected in this matter. Time is too precious to be wasted in search, often fruitless, for an original source, when it could have been indicated, without additional cost, upon the separated copies. It would also be far better if the original page itself could be left intact without overrunning: otherwise errors of reference will be entailed on posterity, which will prove justly exasperating to the student obliged to consult the vast literature of that coming day. The reform cannot come too soon nor be too thorough.

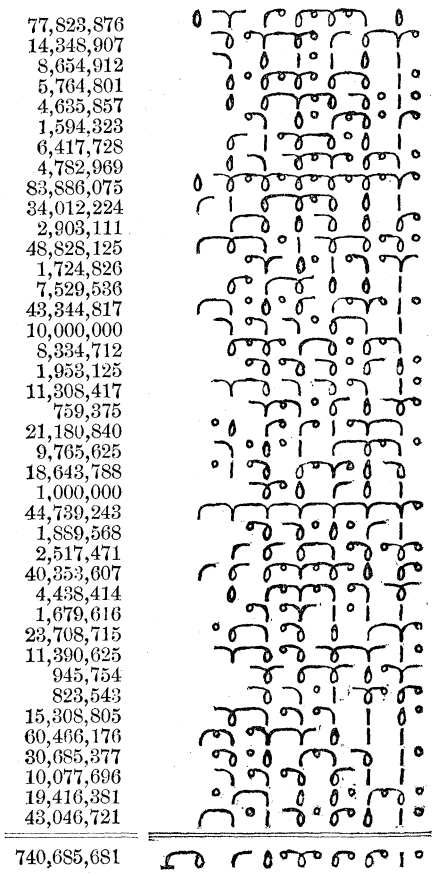
EXPERIMENTS IN BINARY ARITHMETIC.

Those who can perform in that most necessary of all mathematical operations, simple addition, any great number of successive examples, or any single extensive example, without consciousness of a severe mental strain followed by corresponding mental fatigue, are exceptions to a general rule. These troubles are due to the quantity and complexity of the matter with which the mind has to be occupied at the same time that the figures are recognized. The sums of pairs of numbers from zero up to nine form fifty-five distinct propositions that must be borne in memory, and the 'carrying' is a further complication. The strain and consequent weariness are not only felt, but seen, in the mistakes in addition that they cause. They are, in great part, the tax exacted of us by our decimal system of arithmetic. Were only quantities of the same value, in any one column, to be added, our memory would be burdened with nothing more than the succession of numbers in simple counting, or that of multiples of two, three, or four, if the counting is by groups.

It is easy to prove that the most economical way of reducing addition to counting similar quantities is by the binary arithmetic of Leibnitz, which appears in an altered dress, with most of the zero-signs suppressed, in the example below. Opposite each number in the usual figures is here set the same according to a scheme in which the signs of powers of two repeat themselves in periods of four: a very small circle, like a degree-mark, being used to express any fourth power in the series; a long loop, like a narrow 0, any square not a fourth power; a curve upward and to the right, like a phonographic *l*, any double fourth power; and a curve to the right and downward, like a phonographic *r*, any half of a fourth power; with a vertical bar to denote the absence of three successive powers not fourth powers. Thus the equivalent for one million, shown in the

example slightly below the middle, is 2^{16} (represented by a degree-mark in the fifth row of these marks, counting from the right) plus $2^{17}+2^{9}$ (two *l*-curves in the fifth and third places of *l*-curves) plus $2^{18}+2^{14}+2^{6}$ (three loops) plus 2^{19} (the *r*-curve at the extreme left); while the absence of 2^{8}, 2^{2}, and 2^{1}, is shown by the vertical stroke at the right. This equivalent expression may be verified, if desired, either

Example in addition by two notations.



by adding the designated powers of two, from 524,288 down to 64, or by successive multiplications by two, adding one when necessary. The form of characters here exhibited was thought to be the best of nearly three hundred that were devised and considered, and in about sixty cases tested for economic value by actual additions.

In order to add them, the object for which these forty numbers are here presented in two notations, it is not necessary to know just *why* the figures on the right are equal to those on the left, or to know any thing more than the order in which the different forms are to be taken, and the fact that any one has twice the value of one in the column next succeeding it on the right. The addition may be made from the printed page, first covering over the answer with a paper held fast by a weight, to have a place for the figures of the new answer as successively obtained. The fingers will be found a great assistance, especially if one of each hand be used, to point off similar marks in twos, or threes, or fours, — as many together as can be certainly comprehended in a glance of the eye. Counting by fours, if it can be done safely, is preferable, because most rapid. The eye can catch the marks for even powers more easily in going up, and those for odd powers (the *l* and *r* curves) in going down, the columns. Beginning at the lower right-hand corner, we count the right-hand column of small circles, or degree-marks, upwards: they are twenty-three in number. Half of twenty-three is eleven, and one over: one of these marks has therefore to be entered as part of the answer, and eleven carried to the next column, the first one of *l*-curves. But since the curves are most advantageously added downward, it is best, when the first column is finished, simply to remember the remainder from it, and not to set down any thing until the bottom is reached in the addition of the second column, when the remainders, if any, from both columns, can be set down together. In this case, starting with the eleven carried, and counting the number of the *l*-curves, we find ourselves at the bottom with twenty-four, — twelve to carry, and nothing to set down except the degree-mark from the first column. With the twelve we go up the adjoining loop-column, and the sum must be even, as this place is vacant in the answer; the *r*-curve column next, downward, and then another row of degree-marks. The succession must be obvious by this time. When the last column, the one in loops to the extreme left, is added, the sum has to be reduced to unity by successive halvings. Here we seem to have eleven: hence we enter one loop, and carry five to the next place, which, it must be remembered, is of *r*-curves. Halving five, we express the remainder by entering one of these curves, and carry the quotient, two, to the degree-mark place. Halving again gives one in the next place, that of *l*-curves; and the work is complete.

It is recommended that this work be gone over several times for practice, until the appearance and order of the characters, and the details of the method, become familiar; that,

when the work can be done mechanically and without hesitation, the time occupied in a complete addition of the example, and the mistakes made in it, be carefully noted; that this be done several times, with an interval of some days between the trials, and the result of each trial kept separate; that the time and mistakes by the ordinary figures in the same example, in several trials, be observed for comparison. Please pay particular attention to the difference in the kind of work required by the two methods in its bearing on two questions, — which of them would be easier to work by for hours together, supposing both equally well learned? and in which of them could a reasonable degree of skill be more readily acquired by a beginner? The answer to these questions, if the comparison be a fair one, is as little to be doubted as is their high importance.

Eight volunteer observers to whom this example has already been submitted showed wide difference in arithmetical skill. One of them took but a few seconds over two minutes, in the best of six trials, to add by the usual figures, and set down the sum, but one figure in all the six additions being wrong; another added once in ten minutes fifty-seven seconds, and once in eleven minutes seven seconds, with half the figures wrong each time. The last-mentioned observer had had very little training in arithmetical work, but perhaps that gave a fairer comparison. In the binary figures she made three additions in between seven and eight minutes, with but one place wrong in the three. With four of the observers the binary notation required nearly double the time. These observers were all well practised in computation. Their best record, five minutes eighteen seconds, was made by one whose best record was two minutes forty seconds in ordinary figures. The author's own best results were two minutes thirty-eight seconds binary, and three minutes twenty-three seconds usual. He thus proved himself inferior to the last observer, as an adder, by a system in which both were equally well trained; but a greater familiarity (extending over a few weeks instead of a few hours) with methods in binary addition enabled him to work twice as fast with them. Of the author's nine additions by the usual figures, four were wrong in one figure each; of his thirty-two additions by different forms of binary notation, five were wrong, one of them in two places. One observer found that he required one minute thirty-three seconds to add a single column (average of five tried) by the usual figures, and fifteen seconds to count the characters in one (average of six tried) by the binary. Though these additions were rather slow, the results are interesting. They show, making allowance for the greater number of columns (three and a third times as many) required by the binary plan, a saving of nearly half; but they also illustrate the necessity of practice. This observer succeeded with the binary arithmetic by avoiding the sources of delay that particularly embarrass the beginner, by contenting himself with counting only, and not stopping to divide by two, to set down an unfamiliar character, or to recognize the mark by which he must distinguish his next column. One well-known member of the Washington philosophical society and of the American association for the advancement of science, who declined the actual trial as too severe a task, estimated his probable time with ordinary figures at twenty minutes, with strong chances of a wrong result, after all.

These statistics prove the existence of a class of persons who can do faster and more reliable work by the binary reckoning. But too much should not be made of them. Let them serve as specimens of facts of which a great many more are to be desired, bearing on a question of grave importance. Is it not worth our while to know, if we can, by impartial tests, whether the tax imposed on our working brains by the system of arithmetic in daily use is the necessary price of a blessing enjoyed, or an oppression? If the strain produced by greater complexity and intensity of mental labor is compensated by a correspondingly greater rapidity in dealing with figures, the former may be the case. If, on the contrary, a little practice suffices to turn the balance of rapidity, for all but a small body of highly drilled experts, in favor of an easier system, the latter must be. This is the question that the readers of SCIENCE are invited to help in deciding. The difficulties attending a complete revolution in the prevalent system of reckoning are confessedly stupendous; but they do not render undesirable the knowledge that experiment alone can give, whether or not the cost of that system is unreasonably high; nor should they prevent those who accord them the fullest recognition from assisting to furnish the necessary facts.

Those who are willing to undertake the addition on the plan proposed or on any better plan, or who will submit it to such acquaintances, skilled or unskilled, as may be persuaded to take the trouble to learn the mechanism of binary adding, will confer a great favor by informing the writer of the time occupied, and

number of mistakes made, in each addition. All observations and suggestions relating to the subject will be most gratefully received.

HENRY FARQUHAR.

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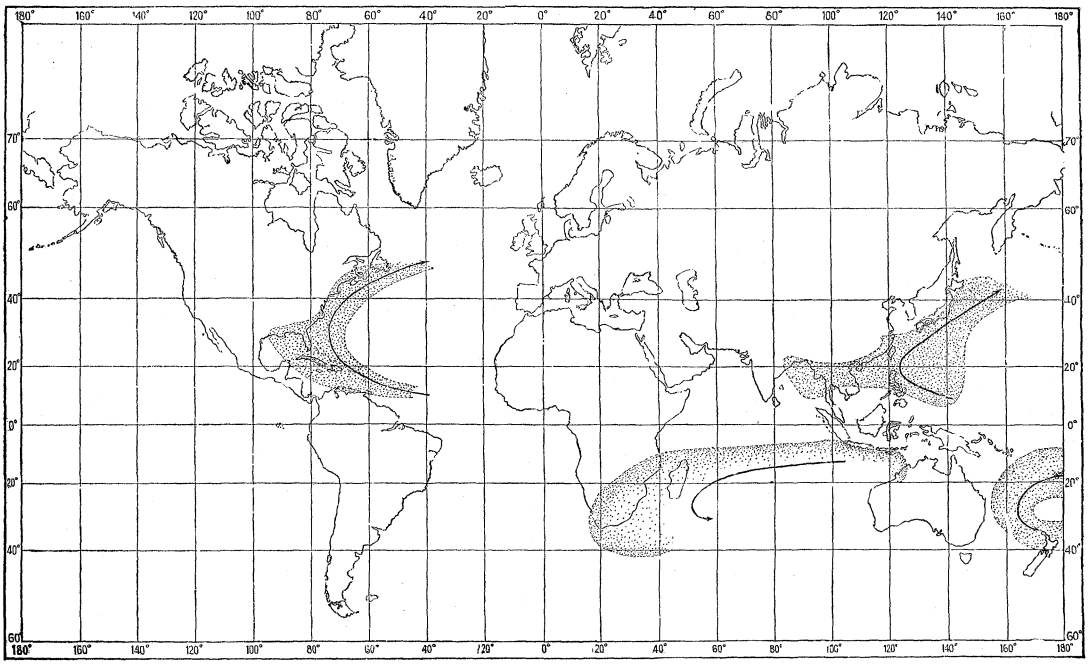
Washington, D.C.

WHIRLWINDS, CYCLONES, AND TORNADOES.[1] — VI.

HAVING seen how storms arise, and examined the general motions of their spiral winds, we must next consider their progression from place to place. It is now a familiar fact, that storms do not remain stationary, but advance forth. The apparently lawless winds of a storm could be reduced to system if they were supposed to blow around a centre which itself has a progressive motion. In nearing the centre, the barometer falls, and the winds increase their strength. The manner and cause of the progressive motion must now be examined.

The four regions where tropical storms move into temperate latitudes — the seas south and east of India and China, and south-east of the United States, in the northern hemisphere; and those east of Madagascar and (probably) of Australia, in the southern hemisphere — are



THE REGIONS OF TROPICAL CYCLONES. (TAKEN FROM STIELER'S ATLAS.)

at a velocity of from five to fifty miles an hour along a line known as their track. Although perceived by Franklin about 1750, this, as well as their whirling motion, first found full and satisfactory proof at the hands of Dove of Berlin (1828), and Redfield of New York (1831). The latter gave the more numerous examples, and was the first to explain the motions of storm-winds at sea. The method of his discovery was simple enough. Information concerning the storm was gathered from all attainable records, and the condition of the winds and weather was plotted for certain hours. At once the result stood clearly all crossed by storm-tracks, running first westward near the equator, then turning toward the pole, and passing around the apex of a parabolic curve near latitude 30°, into an obliquely eastward course. The more numerous storms of temperate latitudes have less regular tracks, but are nearly always characterized by a strong eastward element in their motion; their chief variations to the right or left being dependent on thermal changes with the seasons, and on the configuration of land and water which they traverse. There have been four causes suggested to determine the progression of the storm-centre: namely, the general winds of the region, and especially the stronger and less

[1] Continued from No. 44.

variable upper currents; the supply of warm, moist air, and consequent occurrence of heavy rain; the relative strength of the inblowing winds; and a certain effect of the earth's rotation. All these causes of progression are variable in amount, and in relation to one another; and it is therefore natural to find their resultant inconstant.

The first-named cause is the most evident, the most powerful, and was the first recognized. The general or planetary circulation of the winds will require that any disturbance in the moving atmosphere shall partake of its motion, and be carried along in the direction of the current within which it is generated. Thus a storm arising in the equatorial calms is carried westward as soon as it attains sufficient height to reach the upper current, which must there move from east to west. No equatorial cyclone has ever been observed moving eastward. On approaching the western shores of the ocean, a part, at least, of the general winds, turns toward the poles, as may be seen on any wind-chart, and in latitude 25° or 30° passes from the region of the tropical winds into the system of the prevailing westerly winds of temperate latitudes. The storms have a strikingly similar course, and, on the western side of the oceans in these latitudes, never move towards the equator. Their further progress, and that of the many storms of the temperate zones, is easterly, with a leaning towards the pole while crossing the oceans, and a variable north-easterly or south-easterly advance on the continents. No storm has been found crossing the North Atlantic from east to west, or moving from our Atlantic coast to the plains beyond the Mississippi. Additional evidence of this style of bodily transference of storms will be given in considering the relative strength and the direction of their spiral winds on different sides of the centre.

The importance of the condensation of vapor and consequent rainfall in decreasing the cooling of the central up-draught, and so increasing its strength, has already been shown. In the explanation of this process, it was tacitly assumed that all the surface-indraught was equally warm and moist, so that condensation and rain would occur symmetrically about the centre of low pressure. It will now be seen, that, when a storm-centre is supplied from areas of unequal warmth and moisture, symmetrical cloud-forming and rain-falling on all sides will be impossible; there will be more rain, and hence less cooling, on one side than on the other; and just as the liberation of 'latent heat' aided in the formation of the first central barometric depression, so it will now tend to displace this centre to the side where the greatest amount of rain falls. If no other cause but this acted, the storm would advance regularly toward the region of heaviest precipitation: but this advance will not be like the bodily transference of the rotating winds effected by the general atmospheric currents; it will be rather the abandoning of one centre of attraction as a stronger one is created beside it, — the continual filling-up of one depression, and production of another. This may be illustrated by a modification of fig. 8, given here in fig. 12, in which the dotted lines show the gradients and winds established at a certain period of the storm. Let it be supposed that warmer, moister winds enter

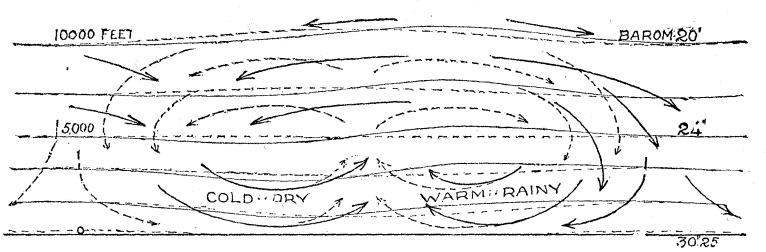


FIG. 12.

on the right, and cooler, drier winds, on the left. Where cooler, the air will be contracted, and the isobaric surfaces depressed: where warmer, from its own warmth, as well as from that of the condensing vapor, the air will be expanded, and the isobars elevated, as shown in full lines in the figure. The gradients will then be unsymmetrical about the original centre; and the previous motion of the winds will be accelerated at some points, retarded or reversed at others. As a result, the pressures at the surface will be changed from their previous arrangement to a new one, shown in fig. 13, in which the region of least pressure has moved to the side of the warmer winds and heavier rains. Any further inflow of the surrounding air must now be to the new low-pressure centre: in other words, the storm has advanced to the right. The process will be continuous as long as the winds on opposite sides of the storm are unlike.[1] Having thus

[1] Fig. 12 may serve further to explain the retarded arrival of the centre of low pressure at altitudes of a mile or more above

seen the general action of this cause of motion, it must now be applied more directly. There are two causes of rain in a cyclonic storm, — one from the expansion and cooling of the moist air as it enters the district of low pressure, and rises in the central up-draught; the other from the advance of the wind from a warmer into a cooler region. The first of these will generally be nearly symmetrical about the storm-centre, and hence not productive of any progressive motion: the second will as generally be unsymmetrical. In fig. 14, for the northern hemisphere, the parallel lines represent normal east and west isotherms, showing the usual decrease of temperature to the north. Of the several winds blowing inward to the storm-centre, *A* and *B*, which advance almost along the same isotherm, will not be seriously changed in temperature by their change of place; *C*, which comes from a cooler to a

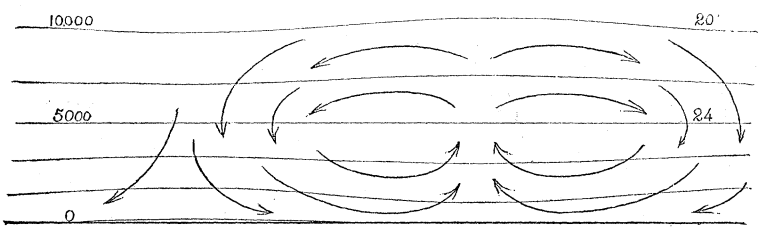


Fig. 13.

warmer district, will consequently increase its capacity for moisture, and be a clear, cold, drying wind; but *D* will be chilled, and must produce heavy clouds and strong rain somewhere about the shaded part of the figure; and the storm-centre will then be transferred toward the middle of this rainy district.

Standing on the warm side of the storm, the centre will appear to move nearly along the isotherms to the right. Actual isotherms seldom follow lines of latitude, and always vary their position with the seasons, especially along continental borders. Thus, over western Europe and the eastern margin of the Atlantic, the summer isotherms run to the north-east: so do the storms. In winter the isotherms run south-eastward, and the storms turn in the same direction. Figs. 15 and 16, illustrating this change, are based on diagrams in the 'Laws of the winds,' by Ley, who first, some fifteen years ago, called attention to the control of rain over storm-tracks. It should be noted that the change in the

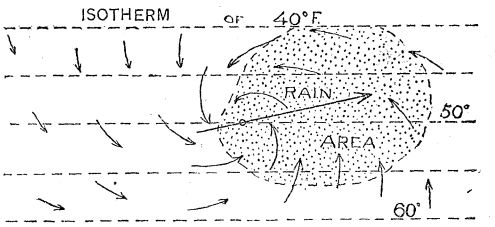


Fig. 14.

winter and summer prevalent winds would have a similar effect on the courses of European storms. In the United States, Professor Loomis has shown that the velocity, as well as the direction of advance, is closely dependent on the position and amount of the rain. In tropical storms the action of this cause of progression is not so clearly marked; for all the winds are moist, and almost equally warm. It is reported that the rainy area often extends farthest ahead of the storm; but it is not at once apparent why it should, for the front of the storm is occupied by winds from the north, which come from a slightly cooler latitude. It may be suggested, that, as their source in a region of high pressure (the 'horse latitudes') causes them to move faster, it also, probably, allows them a greater expansion and cooling, on entering the storm-area, than is permitted in the winds that come more slowly from the equatorial region of low pressure; but tropical storms probably de-

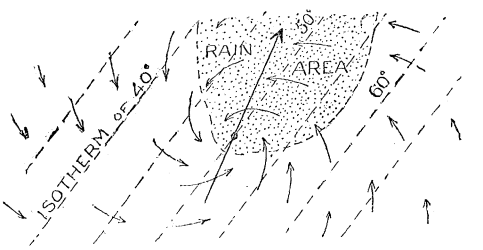


Fig. 15.

pend chiefly on the prevalent winds for their direction and rate of advance. In Austria none of the winds are very moist, and the rainy area has no definite relation to the advance of the

the surface. Observations on Mount Washington have shown the centre of low pressure there to be about two hundred miles behind that at sea-level (Loomis), and a similar retardation has been inferred in England from observations of cirrus-clouds (Ley). Fig. 12 shows this to be directly connected with rainfall; for, in this unsymmetrical storm, the former horizontal neutral plane is distorted, so that the centre of low pressure in the upper air is clearly behind, instead of vertically above, the centre on the surface of the earth.

storm: hence here, also, other causes than rain determine the general easterly progression. Whatever effect rain would have is overcome by stronger causes. The separation of a cyclone into two independent storms is probably aided by the irregular distribution of rain.

Inequality in the strength of the inblowing winds is a result of irregular distribution of barometric pressure in the regions around the storm; and the stronger indraught will come from the higher pressure, because the gradients will be steepest on that side. Thus, in the case of the West India hurricanes, the higher pressure is to the north or north-east in the 'horse latitudes' above named, and the lower pressure to the south, near the equator; and the northerly winds will therefore be stronger than the southerly. The stronger the wind, the greater its centrifugal force;

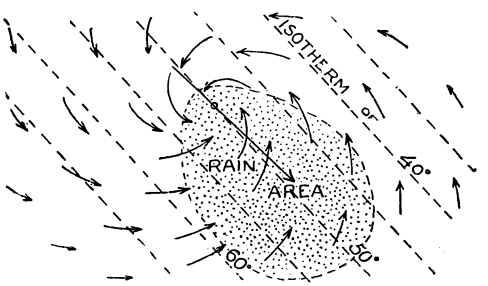


FIG. 16.

and, if this is not equal on all sides, the centre of lowest pressure will be drawn toward the point where it is strongest. This will be where it has to bend sharply around from its original direction, and may average about 135° from the source of the wind: hence, if the stronger wind come from the north-east, the storm-centre will move west; if from the east, north-west, as in fig. 17; and so on. Consequently, this cause will aid the first named in requiring the storm to describe a curved track in passing from the torrid to the temperate zone. It will also aid the coalescing of two neighboring storms, which has not unfrequently been observed; but, as a rule, it plays a subordinate part in determining the direction of advance. The slower advance of such of our storms as have extra strong winds on their western side (Loomis) is probably also due to this cause.

The fourth cause of a storm's advance is a peculiar effect of the deflective force arising from the earth's rotation. It has already been shown that this force increases toward the poles: it will therefore be greatest on the polar side of a cyclone; and the greater the

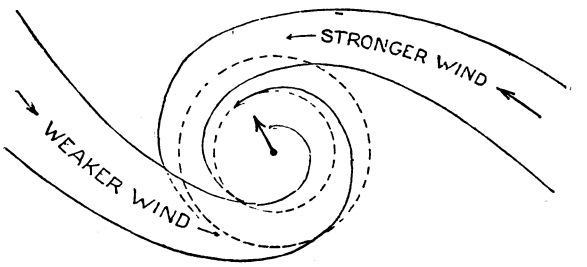


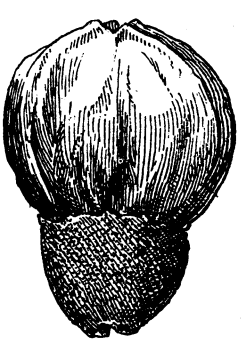
FIG. 17.

storm's diameter, the more marked the difference between the two sides. Its effect will be to make the centrifugal force on the two sides unequal, as in the previous cause; but the resultant motion will here be always from the equator. In the absence of other causes of motion, cyclones would therefore move along meridians: as it is, they nearly always have a more or less pronounced polar tendency; and their failure to move directly from the equator is due to the other causes of progression already mentioned.

(To be continued.)

A COMBINATION WALNUT.

A PECULIAR nut has recently been sent to me from Mr. S. L. Bingaman, Pughtown, Chester county, Penn. It was found on his lawn under a black-walnut tree (Juglans nigra). Mr. Bingaman says, "There is a pecan about sixty feet from it [the walnut-tree], and a shellbark some three hundred yards off." The nut is divided into two parts, as viewed upon the outside. There is a small portion at the base end, which has a covering similar to that of a black walnut. The upper and larger part of the nut has a covering closely resembling that of a shellbark (Carya alba). This exocarp is four-valved, and a partial separation has taken place at the upper end. In its texture and adherence to the shell this covering is much like that of the ordinary black walnut. Upon cutting the nut in two, the shell



(endocarp) is found thick, horny, and in all respects like that of J. nigra. The lower portion of the shell projects into the lower section of the nut, and resembles the point of a butternut. The engraving is from a carefully executed drawing, representing the nut of natural size.

The matter as above presented is left in the hands of those more familiar with subjects in teratology. There is no doubt that in the cross-fertilization of plants we may have a deviation from the parent form, even in the development of the seed thus fertilized, or in its surrounding parts. Some strawberry-growers are very careful what 'perfect' varieties are grown among their pistillate sorts to fertilize them. The fleshy receptacle, which is the edible portion of the strawberry, is more remote from the ovules which are fertilized on its surface than the covering of a shellbark or walnut is from the embryo within.

Hybridization between closely related genera is well established in several cases. Sachs mentions that it has been observed between species of Lychnis and Silene, Rhododendron and Azalea, Rhododendron and Rhodora, Azalea and Rhodora, Rhododendron and Kalmia, Aegilops and Triticum, and between Echinocactus, Cereus, and Phylocactus. The two genera Juglans and Carya compose a small order of closely related species. A study of the generic characters, as set down in the classification of these species, does not reveal any more striking difference than that shown in the exocarp. The male and female flowers are separated on the same tree (monoecious), and pollen must pass from flower to flower. This fertilizing-dust is produced in great abundance; and the distance between the black walnut and the pecan, or even the shellbark, is easily traversed by the pollen. There is probably no difficulty in the way of hybridizing from a difference of time in the flowering of the species. Byron D. Halsted.

New York, Oct. 26, 1883.

MANAYUNKIA SPECIOSA.

In a paper, illustrated with a plate, recently presented to the Academy of natural sciences of Philadelphia, Professor Joseph Leidy describes Manayunkia as a cephalobranchiate annelid living in fresh water, the only one of the order yet discovered not living in the ocean. It was found with the equally remarkable polyzoan Urnatella, with its tubes of mud attached to the same stones, in the Schuylkill River, at Philadelphia. It was first noticed, and a brief description given of it, in the Proceedings of the academy in 1858.

Manayunkia is nearly related to the marine genus Fabricia, with a species of which, described by Professor Verrill, the writer compared it, through specimens collected at Newport, R.I., and Gloucester, Mass. Manayunkia has not been observed elsewhere until recently, when it was found by Mr. Edward Potts, attached to a fragment of pine bark from Egg-Harbor River, New Jersey.

The tubes of Manayunkia are simple or compound, and in one instance five tubes branched and were pendent from a common stock in a candelabra-like manner. The little worm is very active and sensitive, and on the slightest disturbance withdraws into its tube. When quiet it protrudes its head, and spreads its cephalic tentacles or branchiae. The mature worm is three or four millimetres long, and is divided into twelve segments, including the head. The color is olive-greenish, due to the bright green blood circulating in the vessels of the animal. The head is furnished with a pair of conspicuous eyes, and supports a lateral pair of lophophores, each provided with sixteen cylindrical tentacles, invested with actively moving cilia, and closely resembling those of the polyzoa. The segments succeeding the head are provided with lateral fascicles of locomotive setae, and in addition, except the first one, are further provided with fascicles of pedal hooks.

The seventh segment is much larger than any of the others, and further differs from them in being greatly expanded in front; so that it gave rise to the idea that the worm undergoes division, though the process was at no time observed. The intestine is quite simple. The chief portions of the vascular system consist in a vast sinus enclosing the intestinal canal, giving off lateral pairs of branches to the segments, and a large vessel which extends from each side of the head into one of the tentacles, which is larger than the others. The blood is bright green, and is observed to be incessantly pumped into and expelled from the larger pair of tentacles. Ovaries occupy the segments from the fourth to the sixth inclusive. Organs supposed to be the testes extend from within the head into the third segment.

Manayunkia lays its eggs and rears its young within its own tube. The young, measuring about three-fourths of a millimetre, had the body divided into nine segments, and each lophophore provided with four tentacles.

In the species of Fabricia of our coast the number of segments of the body is the same as in Manayunkia; but the lophophores supporting the tentacles, instead of being simple, are trilobed or trifurcate. Fabricia has eyes in the tail, or last segment, as well as in the head, which is not the case with Manayunkia.

DRAINAGE SYSTEM AND LOESS DISTRIBUTION OF EASTERN IOWA.

These are described by Mr. W. J. McGee in a recent communication to the Philosophical society of Washington. The Mississippi River, where it forms the eastern limit of Iowa, flows somewhat to the east

of south, and then as much to the west of south, giving the boundary an eastward angle in its middle part. The general strike of the rocks in eastern Iowa is south-east; and the dip, which is gentle, is south-west. The broadest outcrops are those of the Niagara and Hamilton formations. The Niagara, having resisted the prequaternary planation, holds an escarpment, the crest of which runs from the extreme eastern point of the state to a point on the Minnesota line fifty miles west of the Mississippi. From this line there is a somewhat rapid descent to the Mississippi, and a gentle slope south-westward to the broad, shallow depression marking the position of the Hamilton. From this valley the ascent is gentle to the water-parting between the Mississippi and Missouri. The general slope of the region west of the Niagara escarpment, considered as a whole, is with the dip to the south-west.

Beside the south-east trending depression marking the Hamilton outcrop, there is a gently sloped and indefinitely outlined but continuous and actual prequaternary valley, extending southward across the eastward projection of the state, and traversing diagonally the upper Silurian, Devonian, and carboniferous rocks.

The north-eastern angle of the state, from the crest of the Niagara escarpment to the Mississippi, belongs to the driftless region. The remainder of the state is covered with drift, and is affected by the undulations characteristic of drift topography.

The general directions of the rivers are from north-west to south-east; but their upper courses swerve a little toward the meridian, and their lower are deflected slightly toward the east, so as to give them a gentle curvature with concavity to the north-east. There is, moreover, a convergence northward, as though they radiated from some point in Minnesota. The variations from this normal system are so few that the drainage is almost unique in its regularity. It is likewise independent of the general topography; for not only do the principal streams flow at right angles to the prevailing slope, and cut through the elevated escarpment when it lies in their way, but, with a single exception, they preserve their courses across the ancient north and south valley.

In their relations to minor topographic features, they conform to two antagonistic laws, — first, they follow in general the ill-defined shallow valleys which characterize the drift-plains; and, second, they flow for one-third of their total courses in narrow gorges, following the axes of a system of elongated ridges which constitute the leading features in the local topography. Moreover, they have in many instances gone out of their direct courses, and deserted valleys seemingly prepared for them, to attain the anomalous positions assumed under the second law of association; and in every such case the gorges have demonstrably been carved by the streams themselves. The avoided valleys are evidently pre-existent: they have not been appreciably eroded since the quaternary, and there has been no recent localized orographic movement.

So the drainage is essentially independent of the general topography, though affected by local topography; and its relations to local topography are largely anomalous.

The loess of the region is continuous stratigraphically, but follows different laws of distribution in different districts. It constitutes the surface throughout the driftless region, and at the margin it overlaps the drift. In the northern part of the drift-covered area it forms narrow bands with a general north-west trend, each of which caps a ridge. Farther south it covers the entire plain, eminences and depressions alike. In the driftless area it rests on and merges into a thin stratum of water-worn erratic material. In the belts traversing the contiguous drift-plain it passes downward into sand, which may, or may not, merge into drift. Elsewhere it reposes on the drift, into which it graduates insensibly. The ridges in which the rivers have carved their anomalous cañons are always loess-topped; and, wherever streams avoid low-lying valleys for high-lying plateaus, the plateaus are of loess exteriorly.

So in its distribution the loess of eastern Iowa is intimately connected with the driftless region, with the drainage, and with the topographic configuration.

In the communication referred to, Mr. McGee offers no explanation, but merely sets forth the facts. His working hypothesis has, however, been published in an earlier paper (*Amer. journ. sc.*, Sept., 1882), and may properly be restated in this connection.

It is now many years since Powell first proposed to class all inconsequent drainage as either antecedent or superimposed; and no later writer has added to the number of categories. In *inconsequent* drainage the courses of the streams are independent of the dip and other structure-elements of the rocks across which they run. If the drainage is older than the rock-structure, — if, for example, the dip has been given to the rock after the establishment of the stream-courses, — the drainage is said to be *antecedent*. If the drainage was established by the configuration of an overlying and unconformable formation, which has disappeared by denudation, the drainage is said to be *superimposed*. In eastern Iowa, the superficial formation being northern drift, which lies with little modification as originally deposited, the hypothesis of antecedent drainage appears quite out of the question, while that of superimposed drainage in the ordinary sense is equally inapplicable. Mr. McGee's working hypothesis is, that the drainage was superimposed in an extraordinary manner; namely, by the ice-sheet. This, he finds reason to believe, was so thin in that region as to have its superficial configuration materially modified by the small inequalities of its bed. Where the ice was retarded by ridges underneath, more time was allowed for superficial waste by melting: so that hollows were produced, and the rivers of the ice-surface came to be established over the ridges of the glacier bed. With the disappearance of the ice, they were stranded upon the hill-tops.

G. K. GILBERT.

LETTERS TO THE EDITOR.

The reefs, keys, and peninsula of Florida.

THE recent appearance of the admirable memoir of A. Agassiz on the reefs of Florida, which I have read with intense pleasure, furnishes me a proper occasion for calling attention to my paper, published in 1857, 'On the agency of the Gulf Stream in the formation of the peninsula and keys of Florida,' [1] and especially to the fact that the most important results reached in that paper have been substantially confirmed by subsequent observations. These results are as follows: —

1. The reefs of Florida are unique, and therefore were formed under peculiar conditions, and therefore, also, require a peculiar explanation.

2. The continuous growth of land by coral agency, in the case of Florida, is also wholly unique, and obviously connected with the peculiar conditions under which the reefs were formed.

3. The main peculiar condition in this case was the formation and southward extension of a submarine bank upon which the corals grew in successive reefs.

4. This bank was due to the agency of the Gulf Stream.

In addition, I supposed that the bank was built up by mechanical sediments brought by the Gulf Stream mainly from the Gulf rivers. In this I may have been mistaken, although no other explanation was conceivable at that time. The recent examinations of the course of the Gulf Stream, which, it seems, does not sweep about the Gulf, as was formerly supposed, and examination of the nature of the material forming the Florida bank, render this view no longer probable.

A. Agassiz in his memoir accepts the progressively formed bank, and also that it is due to the agency of the Gulf Stream, but thinks that it is formed, not by *mechanical* sediments, but by *organic sediments*, partly *brought* by the Gulf Stream from other coral banks (e.g., the Yucatan bank), *but mainly* formed *in situ* by the growth of deep-sea animals; the Gulf Stream bringing not the materials, but only the conditions of heat and abundant food necessary for rapid growth.

This is certainly a very important modification of my original view; but the fundamental ideas expressed in the above four propositions still remain.

I ought to add, that, following L. Agassiz, I had exaggerated the probable amount of land added to Florida by the combined agency of Gulf Stream and corals. The recent investigations of Smith [2] on the geology of Florida show that the process cannot have commenced farther north than the north shores of the Everglades.

JOSEPH LECONTE.

Berkeley, Cal., Nov. 24.

Musical sand.

In the early part of the summer of 1883, the writer, in company with several others, was sent from Wood's Holl to Monomoy Point, Mass., by Professor Baird, to look after a whale reported to have been stranded there. Wandering around the island, we found an extensive tract of sand, which, when rubbed under the feet, produced that peculiar singing sound so often heard by the writer upon the beach at Manchester, Mass. The singing portion seemed to be confined to a narrow strip several hundred yards long, between the very dry sand above high-water mark and the sand moistened by the tides. Knowing that the phenomenon was a rare one, specimens of the sand were obtained; but I am not able to tell where they are at present. Monomoy Point is a long, narrow, sandy piece of land projecting out from the south-eastern end of the base of Cape Cod towards Nantucket Island. It is composed entirely of sand; and the blowing of the particles, as also the force with which they are blown, were well illustrated by the fact that all the windows of the fishermen's huts were ground so perfectly that nothing was visible through them. We paid one fisherman to break a square of glass for us. It had been there sixteen years. Even in cases where new glass had been put in within two years, nothing was visible through the panes. At a distance of thirty feet from the house on all sides, sand was piled up nearly as high as the tops of the cabins. The lighthouse-keeper upon the island would undoubtedly obtain specimens of the sand; the strip being found near the place where the whale lay, — in fact, just a few feet inland from it. The writer will be glad to give any further information desired upon the subject.

R. S. TARR.

Smithsonian institution, Dec. 4, 1883.

[1] *Amer. journ. sc.*, Jan., 1857. [2] *Ibid.*, 1881.

Rings of Saturn.

Apropos of the abstract on the 'Rings of Saturn,' published in SCIENCE for Nov. 16 (p. 660), it appears that Professor Alexander Winchell of the University of Michigan, in his work entitled 'World-life,' assumed and explained the gradual descent of the matter of the rings toward the planet, and also denied that the period of the inner satellite of Mars furnishes any objection to the nebular theory. The ultimate result of solar tides on the rotations of the planets is also referred to in the same work, though this has, I believe, long been an accepted conclusion by leading physical astronomers.

W. B. T.

ARCHEOLOGY IN PORTUGAL.

Études préhistoriques en Portugal. Notice sur quelques stations et monuments prehistoriques. Mémoire présenté à l'académie royale des sciences de Lisbonne. Par CARLOS RIBEIRO, chef de la section des travaux géologiques, etc. Lisbonne, *Imprimerie de l'académie des sciences*, 1880. 88 p., 7 pl., and numerous engravings in the text. 4°. [Also in Portuguese.]

THIS publication, which has only recently been received by us, is the second instalment of a work the first of which appeared in 1878 (72 p., 21 pl.). We will accordingly give a brief account of the contents of both parts. Contrary to our expectations, we find in them no discussion of the important question of the alleged discovery of traces of the tertiary man in the valley of the Tagus; neither do they deal with quaternary times. They contain simply detailed accounts, with ample illustrations, of various discoveries, all belonging to the age of polished stone, made by the author in several localities in the immediate neighborhood of Lisbon, which are all laid down upon an accompanying map drawn to a large scale. The completed work will comprise six sections, three of which are contained in the two portions already published. Of these, the first describes the station of Licca, and the second,

the megalithic monuments near Bellas; both of which places lie a short distance west of Lisbon. The latter also contains an account of the prehistoric remains at the Serra de Cintra, several miles farther west.

Licea is a little hamlet built upon the projection of an elevated plateau, of which two of the sides are naturally defended by deep ravines. In this respect it resembles other sites of human habitation in the age of polished stone, which were usually placed upon commanding positions, easily defensible, and having plenty of water. This naturally strong position was rendered more secure by having its sides sharply scarped in some parts; while in others, not so protected, there can still be seen remains of a wall built of huge unhewn stones. The whole area was thus converted into an intrenched camp of an oval shape, nearly half a mile long by half as broad. Within this space, excavations have brought to light various objects of the usual types belonging to the industry of the age of polished stone. There were numerous celts made of diorite or of basalt, some finely polished, well shaped, and with sharp cutting-edges, while others were of a ruder fabric; and also several hammer-stones. Knives, flakes, scrapers, arrow-heads, and lance-points abounded, made of different varieties of flint, many of which must have been brought from long distances. Rude clay vases, hand-made, and some of a large size, all baked in an open fire, together with a few bone implements, complete the catalogue of objects found. Associated with these relics were the remains of shell-fish, and the bones of several species of animals common in neolithic stations, such as the horse, ox, stag, goat, pig, wolf, and hare. There was also discovered a sepulchral grotto containing bones belonging to nine individuals of both sexes, half at least of which were those of very young children. We have good reason to believe that other similar caverns have been either destroyed, or filled up with the rubbish of the chalk-quarries that have been extensively worked in this locality. In the absence of a perfect cranium, nothing more could be determined than that the type was brachycephalic. From the general result of all the discoveries, the conclusion seems warranted that Licea was the habitation of a large population during the neolithic period. Signor Ribeiro, however, brings forward certain arguments to prove the existence of a second prehistoric civilization upon this same spot, belonging to the period of transition between the age of polished stone and that of bronze. But we must confess ourselves unable to perceive their pertinency; neither can we agree with him in thinking that any of the implements discovered here have 'a striking paleolithic appearance.'

In the vicinity of Bellas there still exist megalithic monuments, consisting of a half-dozen ruined dolmens, in which but little of importance was discovered, owing to their having been visited by previous explorers; nevertheless, two or three singular objects were found in them, which will be described later. Hard by, however, at Monte Abrahão, there is a covered alley in an excellent state of preservation, which has yielded important results. It is composed of a polygonal chamber some ten feet in diameter, and a gallery twenty-four feet long by six wide, extending in an easterly direction. The walls of the chamber are constructed of eight large slabs of hard gray limestone, rough, and entirely unhewn, planted more or less upright, and projecting some nine feet above the surface of the soil. It is evident, however, from the inclination at which the largest stone is placed, that it was not intended to be roofed over by a similar slab after the usual method of constructing such monuments. There had first been made with infinite toil, by the help of fire, an excavation in the solid limestone strata of the whole size of the chamber; and in this the large slabs were set. Of those with which the gallery was originally constructed, only three now remain in place; but the rows of smaller stones, by which they had been supported, were discovered when the surface-soil was removed, so that there can be no mistake as to the existence and extent of the gallery. It is admitted that dolmens and covered alleys were erected to serve as burial-places of the men of the neolithic age: consequently we are not surprised that Signor Ribeiro found this monument to contain human remains; but the number of them was quite unusual, amounting to as many as eighty individuals. This can be accounted for by the fact that certain circumstances seem to indicate that some of the remains had been interred elsewhere before they were removed to this resting-place. They were found in the gallery, as well as in the chamber; and it seems reasonable to suppose that there had been successive burials at intervals of time, and consequent disturbances of the soil, which would account for the situation in which many of the bones were found. Their condition was such as to allow but few inferences to be drawn as to their ethnic relations, no whole cranium having been found: sufficient, however, remained of one, to show it to be

dolichocephalic, and one of the jaw-bones was prognathic. In this interment, however, was one peculiarity which we have never seen noticed before. Over the whole interior, but particularly at the eastern extremity of the gallery, there was spread a layer of rounded pebbles, covering the human remains. They ranged in size from an almond to a large apple, and were mostly of quartzite, though many were of limestone, and several of basalt. Evidently they had been brought from the beds of neighboring brooks lying some three hundred feet or more below the level on which the monument stood. That they were not intended merely to protect the bodies from wild beasts was plain, from the fact that the adjacent soil was filled with angular fragments of various rocks equally well adapted for that purpose. Here we have evidently a funereal custom analogous to the heaping-up of cairns over the dead by many primitive races.

Numerous objects of great beauty and interest were found accompanying the skeletons. Among them were only four celts; but there were no less than one hundred and twenty flint arrow-heads, very many of them of the choicest workmanship, and including all the well-known types which are figured in excellent woodcuts. There were found two very fine specimens of flint lance-heads, or more probably daggers, more than six inches in length, and of exquisite workmanship; and more than thirty knives, ranging in length from five inches down. There were also scrapers, numerous flakes, and fragments of worked flint of various sorts. Our author devotes an entire plate to a delineation of some twenty little instruments, some of which he thinks were "designed for delicate work, such as *the surgical operation of circumcision* (?), *and trepanning.*" Another of larger size, disk-shaped, and terminating in front in a little point, and capable of standing upright on its base, his imagination has magnified into 'an idol, or some sort of symbol.' To our more prosaic vision the 'surgical instruments' are only ordinary little stone implements, which in this case happen to be made of transparent quartz; while 'the idol' is merely a piercer for making holes in skins, such as we have often found in our Indian shell-heaps.

There were half a dozen objects of unusual character, which Signor Ribeiro designates as 'war-clubs,' and two others, which he thinks were 'badges of authority.' They are quite similar in appearance, are of cylindrical shape, and made of limestone; and the largest is about a foot in length, and nearly two inches in diameter. A few bone implements were found, among them a button of a conical shape, and pierced at the base with two converging holes. The pottery consisted only of portions of some half a dozen small, rude vases. Two ornaments were found of considerable size, celt-shaped, and made of thin plates of gray argillaceous schist. One face was smoothed, and decorated with figures made by scratching lines upon it in the triangular pattern known by the name of the 'dog-tooth;' and it was pierced with a hole for suspension. Besides these, two smaller heart-shaped pendants were found, and more than a hundred beads of various shapes and sizes, made of different green minerals, out of which the author has reconstructed several tasteful necklaces. Taking every thing into consideration, this covered alley may be said to be one of the richest ever discovered; and we feel grateful to the author for his careful study and faithful delineation of it.

We have already stated that two or three peculiar objects were obtained from some of the ruined dolmens. They are made of thin plates of argillaceous schist, about a foot in length, and some two inches broad, and are shaped somewhat like the curved blade of a sword, having the end rounded, and pierced on the back side with a hole for suspension. Both surfaces are smooth, and are decorated with varying patterns of 'dog-tooth' ornamentation. Two similar objects have been previously discovered in Portugal; but we are confident they have never been met with elsewhere, and their use is entirely unknown. The third object is a sort of stone hoe, according to our author's opinion, shaped very much like a human foot, and having the lower portion of the leg for the handle, the top of which is sharp enough to be used as a scraper. Objects similar to this have been discovered in a cave a short distance to the south.

The Serra (or mountain) of Cintra lies due west of Bellas, and somewhat more distant than the latter place is from Lisbon. It is the most picturesque of all the mountains in the vicinity, and attains an elevation of over fourteen hundred feet. At the very summit is an artificial excavation in the porphyritic and granitic rock, divided into two portions. The inner chamber is circular, with a diameter of twelve feet, and height of nine; the other is a kind of open vestibule about eighteen feet square; and the two are connected by a short covered corridor, while the interior of the whole monument is lined with a wall of rough stones. In it were found a flint knife, or saw (an ellip-

tical shaped implement, toothed around its whole exterior), and a few worked flakes. Fragments of clay vases of various shapes and sizes abounded, many of them having a 'herring-bone' pattern of ornament incised upon them. All of these objects evidently belong to the neolithic period; and the monument itself resembles a sort of combination of the dolmen and the sepulchral grotto.

But a novelty among neolithic interments seems to have been discovered at Folha das Barradas, a short distance to the north-east. This is excavated in the natural soil, a white limestone and green marl, and has almost the shape of a covered alley, twelve yards long, extending east and west. The circular chamber at the west was divided by pieces of thin flagstone into partitions intended to contain human remains, of which as many as twelve were found, but in so bad a condition as to be useless for study.

Accompanying the remains were a flint poniard, two very fine lance-points of unusual size, and seven large knives; also a long cylindrical stone 'war-club,' similar to those previously described, but more handsomely ornamented, and two of the 'badges of authority.' A flat pendant, like those already spoken of, and fragments of a few rude clay vases, completed the funeral furniture. But it should be noted, that both in this sepulchre, and the one last described, there was found a large number of the same kind of rolled pebbles as those which occur so conspicuously in the covered alley of Monte Abrahão.

In concluding this brief account of Signor Ribeiro's interesting researches, we can only express the hope that his recent death, which all lovers of knowledge must deplore, may not deprive prehistoric students of the publication of the remainder of the work.

THEORETICAL METEOROLOGY.

Theoretische meteorologie. Ein versuch die erscheinungen des luftkreises auf grundgesetze zurückzuführen. Von ALBERT R. v. MILLER-HAUENFELS. Wien, *Spielhagen & Schurich*, 1883. 130 p. 8°.

THE past twenty years have witnessed a great advance in the science of meteorology, viewed from a theoretical stand-point. Previous to this period, the laws deduced were derived empirically from the observations made; and this is largely true at the present time. The attempts to place the science upon a firmer basis by building upon well-established physical laws, and deducing conclusions by strict mathematical processes, have met with decided success. But this branch of meteorology is yet largely undeveloped: consequently there is no treatise that covers the ground satisfactorily, and there is a large gap between deductive meteorology and the inductive conclusions upon which meteorological text-books are based. The mathematical papers are scattered in the volumes of scientific journals, or published in separate form. Even if they were collected together, and their contents condensed into one treatise, the result would be unsatisfactory. It would be found that a large majority of familiar phenomena are yet unaccounted for, and that many of the conclusions reached by theoretical methods cannot be used for further investigations, on account of assumptions made for the sake of simplifying the work, but which are unwarranted by observed facts. The hope of meteorology as an exact science, however, lies in the success which will attend these theoretical investigations in the future; and therefore any treatise devoted to this branch of the science is welcomed, however fragmentary it may seem to the reader.

The latest publication upon theoretical meteorology is this octavo of a hundred and thirty pages, by Professor Miller-Hauenfels of Graz. It is confessedly incomplete, but seems to be worthy of the attention of the student. As its title implies, it is an attempt to refer atmospheric phenomena to fundamental laws. The author is not a practical meteorologist, but a mathematician, who treats the phenomena discussed as mechanical problems as far as possible, holding that the first thing necessary is to establish the fundamental laws of meteorology, and afterwards to build upon this secure foundation. In the first section the laws of Mariotte and Gay-Lussac are treated, the method giving essentially the same result as that deduced by Rühlmann in his well-known barometric formula. Passing then to the movements of the atmosphere, the author discusses first its general movement, and then the laws of the winds, the latter subject occupying a large part of the treatise. The laws of ascending currents as developed by Hann are briefly referred to, and the laws of moist air-currents also discussed, the formulae for which are based upon Hildebrandsson's exposition of Dalton's law. The fundamental laws of thermodynamics are the basis of the discussion of the disturbances of density giving rise to winds. Numerous theorems are laid down in connection with the phenomena of the winds, and it is recognized that differences of temperature are the original cause of them. The diurnal change of the barometric pressure is explained in a

manner not unlike that usually followed, and the belief is expressed that the moon has an effect upon the atmosphere which would appear by a proper tabulation of barometric observations.

The above summary is sufficient to give an idea of the scope of the work. It is introduced to the public by Dr. Julius Hann, who remarks, with regard to deductive investigations, "Even where results derived deductively find no immediate application in nature, since the actual conditions are never so simple as those which must furnish the basis of the conclusions reached, yet they are of great interest and value in advancing knowledge, since they increase our insight into the nature of phenomena, and open the path upon which, in the course of time, we shall attain to their complete understanding."

The execution of the author's design, however, is not wholly satisfactory. On account of the fragmentary nature of the work, it is often difficult to understand the bearing of the subjects discussed, or to see what use can be made of the formulae derived. It is also not always easy to follow the author in his argument, and consequently the general effect upon the reader is one of disappointment. The treatise does not merit the title which is given it, though it may furnish useful suggestions to those who are investigating the subjects which it discusses.

HISTORY OF LAND-HOLDING.

The early history of land-holding among the Germans. By DENMAN W. ROSS. Boston, *Soule & Bugbee*, 1883. 8 + 274 p. 8°.

THIS work of Mr. Ross starts from the principle of individual ownership and isolated farmsteads, as the primitive usage of the Germanic nations. The evidence for this the author finds in the sixteenth chapter of the Germania of Tacitus, in which he explains the *vici* to be villages, not of free tribesmen, as is generally assumed, but of serfs. Of community of ownership he finds no evidence, either in Caesar or Tacitus. In the period of the barbarian laws, too, the facts which have usually been understood to point to common or collective ownership he explains as meaning *undivided* property. He has no difficulty in proving the general prevalence of the principle of individual ownership at this latter period, so far as the laws and other documents of the period afford any evidence. That ownership is common wherever it appears in these documents, is as a rule temporary, and subject to individual claims, seems also fully established. The gap in the evidence is as to the two or three centuries which intervened between Tacitus and the barbarian codes, — a gap which is of no importance, if his interpretation of Tacitus is correct, but which leaves room, if that interpretation be not accepted, for the development of free village-communities in this interval, which may then, in some cases, have survived to a later period, by the side of the system of individual ownership which we must accept as the prevalent one for this period.

After developing these general principles, Mr. Ross proceeds (p. 26) to show how the isolated household may, in the course of a few generations, have developed into a clan-village; here, again, into a community of ownership which is not really corporate in character, but is on its way to divided and individual ownership (p. 38). The rules and usages of the inheritance and transfer of land are described with great fulness, after which the usages which appear to tell in favor of an original collective ownership — the rights of *vicini* to exclude strangers, to purchase in preference to strangers, and to inherit in case of lack of heirs — are discussed. Certainly these usages, which, it must be admitted, may accompany a system of private ownership, are, nevertheless, most easily explained on the assumption of a *previous* condition of collective ownership. We cannot think the explanation given on p. 52 to be wholly satisfactory.

The breaking-up of the clan-system is next considered, this being effected especially by female inheritance, adoptions, and alienations. An important topic is the founding of free colonies, off-shoots of the clan-communities, but modelled upon the serf-communities; and their organization and management are described with great fulness and lucidity. The relation between these free villages and the serf-villages — clan-villages of proprietors and of tenants — is discussed; and there is much here that would apply equally well to the village-community theory. They are indeed essentially the same in character with those assumed by that theory, only that they are represented by Mr. Ross as a later outgrowth instead of a primitive organization. The essay (which occupies 109 pages) ends with some brief considerations upon immunity, primogeniture, etc. The conclusions of the essay are supported by a mass of 'Notes and references,' occupying about 130 pages, and containing copious extracts from documents. There is a full index. This book is every way a thorough piece of

work, which certainly places the village-community theory upon the defensive, and overthrows a considerable part of its assumptions; and, apart from its controversial character, as a 'history of land-holding' it possesses the highest value.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

Hyperelliptic integrals. — The full title of this paper by M. Staude is "Geometrische deutung der additionstheoreme der hyperelliptischen integrale und functionen erster ordnung im systeme der confocalen flächen zweiten grades." Only a brief notice of M. Staude's paper is possible in this place, although its importance makes it worthy of a much more extended one. The paper is divided into five chapters. In the first chapter the author considers the geometric significance of the symmetric algebraic functions of two independent variables, and the differentials of the integral functions of an hyperelliptic form (*gebilde*) of deficiency (*geschlecht*). The second chapter treats of the representation of the *gebilde* in systems of confocal surfaces by aid of hyperelliptic functions, and opens by the introduction of certain transcendental parameters in place of the usual elliptic co-ordinates. An expression is also given of the homogeneous point co-ordinates in space in terms of products of the double theta-functions, and also of homogeneous plane co-ordinates in space by aid of products of two double theta-functions. The third chapter is of particular interest from a purely geometrical point of view. In this the author considers the relations of the addition theorem for hyperelliptic integrals to systems of confocal surfaces, treating particularly the reduction of given sums of three integrals to sums of two integrals of the same kind. The fourth and fifth chapters have not yet appeared, but the author mentions their contents. Chapter four is to treat of the ray-systems of common tangents to two confocal surfaces; and chapter five is to be devoted to a geometrical interpretation of Abel's addition theorem, by aid of which the reduction of the sum of any four of the integrals in question to the sum of two integrals of the same kind is arrived at by a purely geometrical process. — (*Math. ann.*, xxii.) T. C. [471

Discontinuous groups of linear substitutions. — The complete title of M. Picard's paper is "Sur une classe de groupes discontinus de substitutions linéaires et sur les fonctions de deux variables indépendantes restant invariable par ces substitutions." The theory of the elliptic functions has given the first example of a uniform function of a variable which does not change for a group of an infinite number of linear non-permutable substitutions effected upon the variable. The modular functions, i.e., the functions arising from considering the modulus as given by the ratio of the two periods, was for the first considered by M. Hermite. M. Poincaré has treated in his theory of the Fuchsian functions, in all its generality, the subject of functions of one variable which are reproduced by a group of an infinite number of linear substitutions. M. Picard, in the present memoir, proposes to consider functions of *two* independent variables which may be considered as analogous to the elliptic modular functions. He shows, first, that the Abelian functions do not conduct to functions entirely analogous to the modular functions, and illustrates this by the Abelian functions of the first order. But by taking the case of the Abelian functions of the second order, i.e., of three variables, he has found an indication of the desired extension, and hopes in a future paper to enter more fully into the subject of functions of two variables which are analogous to the modular functions. The present paper is interesting as pointing out the difficulties, and indicating the manner of overcoming them, in an entirely new department of the theory of functions. — (*Acta math.*, i.) T. C. [472

PHYSICS.

Target-shooting. — From Liagre's theory that errors in target-shooting are compounded of errors in sighting and in levelling, each of which follow independently the law of error, it was shown by Mr. C. H. Kummell that shots of equal probability are arranged in ellipses, which can be reduced to circles of shots uniformly distributed, the integration being much simplified by using the reduced distances and directions. Sir J. Herschel's 'even-chance circle' (ellipse, more generally), the one hit or missed with equal probability, can be deduced from the shots actually found in any given circle (ellipse), the most reliable result being given by the one containing the greatest number of shots, whose radius (mean semi-diameter) is the *most probable* shot. The number of shots falling within this ellipse should be about thirty-nine and one-half per cent. The equations between the even-chance shot (ρ), the most probable shot (ε), and the average shot (r_0), are —

$$\rho = \varepsilon\sqrt{2\,l\,2}, \quad r_0 = \varepsilon\sqrt{\frac{\pi}{2}}.$$

In determining these from the sums of squares of the vertical and horizontal co-ordinates of the separate shots, the number that miss the target should be considered. The probable position of centre and axes should not be calculated from the observations, unless the true positions are unknown. A target of ninety shots at eight hundred yards' range, by the Irish team at Creedmoor in 1874, gave discrepancies of less than five per cent between observation and theory, in the number of shots within successive rings. One of fifty pistol-shots, at fifty yards' range, showed a similar agreement. — (*Phil. soc. Wash., math. sect.; meeting* Nov. 21.) [473

ENGINEERING.

Honigman's fireless locomotive. — Mr. Honigman constructs an engine in which the steam is supplied by evaporation from a charge of water which is furnished to the boiler at the station, and there brought up to the required temperature and pressure. The shell of the boiler is surrounded by, or may enclose, another vessel, between which and the boiler a narrow space is left, which is filled with caustic soda. The exhaust-steam is discharged into this mass of soda, which at once absorbs it; and the absorption gives rise to a large amount of heat, which is in turn given out, and returned to the water in the boiler, where it produces an additional quantity of steam; and the latter, being exhausted into the compartment containing soda, gives rise to additional quantities of heat; and thus the process is continuous, and the locomotive continues to exert its power, until the solution of soda becomes so far saturated that it can no longer take up the exhausted steam, and supply heat to the boiler, with sufficient rapidity to enable the engine to do its work. When this state of affairs is reached, the engine is recharged, and is again sent out on the line. The soda removed from the exhausted engine is placed in an evaporator and deprived of its moisture, and is then again ready for further service. This seems to be the first attempt to make practical application of the now well-known principle discovered by Faraday sixty years ago, and probably even earlier known on the continent of Europe. It is reported to be tolerably successful, and likely to have practical use where the presence of a fired engine is not permissible. — (*Lond. engineering*, Aug.) R. H. T. [474

Compound locomotives in Europe. — Mr. Borries has read a paper before the Union of German engineers, relating the progress of the compound engine on German railways. They were first introduced by A. Mallet of Paris. There are now forty of these engines at work. They are worked either simple or compound, as desired. They are economical, and may be worked with a wide variation in the amount of power developed, but are somewhat complicated, do not distribute the steam in the manner sometimes found practically desirable in working, and the action of the steam during compression leaves something still to be desired. Mr. Borries has endeavored to obtain a system which should permit the use of double expansion at all times, should be simple, and should permit the proper adjustment of the ratio of expansion at any time, if possible. At starting, steam is admitted to both cylinders, reaching the large engine-cylinder through a 'reducing-valve;' but, after starting, the machine works as a compound engine. At all points of cut-off, he gets nearly equal work done in each cylinder. The engine works easily, and no spark-arrester is needed. The excess of weight and cost is about four per cent above that of other engines: the gain in power is six per cent, and in economy of fuel nine and a half per cent. The engine is considered a success. The best results are reported from passenger-engines thus constructed. — (*Lond. engineering*, Aug.) R. H. T. [475

Finishing rails. — M. Gazan writes to *La métallurgie*, saying that the chemical composition of the steel has very little to do with the strength of the rail: it depends more upon the temperature at which the rail is finished in the mill. Those finished at a high red heat, and which are recognizable by their blue tint, are more brittle and weaker than those which are finished at a lower heat. The latter are usually covered with a reddish colored layer of oxide. In the former case the fracture exhibits a granular, and in the latter case a good steely, surface. M. Gazan thinks, that, in the former case, time is allowed for the formation of crystals which cannot be produced in the latter. If the red-hot metal be worked until it has fallen below the red heat, it does not exhibit crystallization. — (*Railway rev.*, Sept. 8.) R. H. T. [476

Compound engines and boilers. — Mr. M. Coryell, a member of the U. S. naval advisory board, writes that good results have been obtained from recent compound engines. Pressures rarely exceed 100 pounds per square inch (8 atmos. nearly, absolute pressures); but he thinks 150 (11 atmos., absolute) can be carried by adopting, instead of the 'Scotch boiler,' a boiler of but 6 feet diameter (1.8 metres), with cylindrical shell and set in brick-work, — a plan of which great distrust has hitherto been felt by engineers. He suggests a still better scheme, however, — a water-tube 'sectional' boiler, safe for 200 pounds. This would permit fire-surfaces of but a quarter-inch (0.6 centimetre) iron. The use of fire-brick furnace-walls is found to give some economy of fuel. He has found high pressures and great expansion to give good results, and states that at least one successful designer would exceed 20 expansions, — a proposal which is not looked upon with favor by leading engineers. Mr. Coryell would use the beam-engine for screw-ships on account of its perfect balance. He states that engines of 6 feet stroke are in use, making 60 revolutions per minute with 60 pounds (5 atmos.) of steam and a cut-off at 5 inches (i.e., a ratio of expansion of 14.4), and that these engines have been in successful use for nine years, making voyages of five days without detention and with economy. Engines of 88 inches (2.235 metres) stroke have averaged 58, and have sometimes made 71, revolutions per minute. He thinks 4 feet (1.22 metres) the shortest advisable stroke for marine engines, and believes that twice that length will ultimately become common. — (*Mech. eng.*, Sept. 29.) R. H. T. [477

CHEMISTRY.

(General, physical, and inorganic.)

Active oxygen. — For the purpose of testing the accuracy of his conclusion relating to the action of moist phosphorus on carbonic oxide, which seemed to be disproved by the results of Remsen and Kaiser (SCIENCE, i. **704**), E. Baumann has repeated his experiments, using apparatus closed with glass stoppers, and taking every precaution to avoid contact of the gases with organic matter of any kind. In one experiment, seven hundred cubic centimetres of carbonic oxide, diluted with air, after passing through the apparatus, in fifteen hours gave 36.6 milligrams of

carbonic dioxide, or 2.6 % of the carbonic oxide was converted into carbonic dioxide. In a second experiment, thirty litres of air containing 2.45 litres of carbonic oxide, when passed through the apparatus, in twelve hours gave 64.6 milligrams of carbonic dioxide, or 1.3 %. The temperature varied between 20° and 26°. Baumann found, further, that hydrogen peroxide was not produced when air was passed over palladium hydrogen, although carbonic oxide was oxidized to a small extent. He concludes, with Hoppe-Seyler, that this oxidation is due to the presence of oxygen in its active condition. — (*Berichte deutsch. chem. gesellsch.*, xvi. 2146.) C. F. M. **478**

Determination of the atomic weight of antimony. — J. Bongartz prepared metallic antimony from antimonious chloride, which had previously been purified by six or eight fractional distillations. The metal was separated by electrolysis according to Classen's method, and it was converted into the sulphide by heating with potassic sulphide. Determinations of sulphur in the purified sulphide were made by Classen's method; viz., by oxidation with hydric peroxide, and weighing the sulphuric acid thus obtained as baric sulphate. The mean of twelve determinations gave 120.193. — (*Berichte deutsch. chem. gesellsch.*, xvi. 359.) C. F. M. **[479**

AGRICULTURE.

Conductivity of soils. — Wagner has made a somewhat extended investigation of the thermal conductivity of various constituents of soils and of the effect upon it of alterations in the structure of the soil and in its moisture. The materials used were quartz sand, kaoline, precipitated calcium carbonate, ferric hydrate, peat extracted with acid and alcohol, and artificial humus prepared from sugar. The quartz was found to be the best conductor, and the humus the poorest, while the other materials occupied intermediate positions. The differences were small, however, and of little significance, compared with those due to differences of texture, compactness, and moisture. Experiments with two natural (calcareous) soils showed that heat was transmitted more slowly in a loose soil than in the same soil compacted, and that these differences were greater the greater the water-content of the soil. The latter factor, indeed, seemed to have more influence than any other. Its effect is due, according to the author, to the fact that it is a somewhat better conductor than the air which it replaces in the interstices of the soil. The heat was transmitted horizontally, so that there was little chance for the transmission of heat by convection. The effect of compacting the material was also studied on the six soil-ingredients mentioned above; and the compacted material was found to transmit heat better than the loose, in every case except the humus, of which the reverse was true. The conductivity was found to increase with the size of the particles or aggregates of which the soil was composed. Observations were also made on the daily variations of temperature at different depths in sand, clay, and peat. The variations were greatest, and extended to the greatest depth, in the sand. The peat stood at the opposite extreme, and the clay between the two; in these respects, their positions corresponding to their relative conductivity as previously determined. — (*Forschr. agr. physik.*, vi. 1.) H. P. A. **[480**

GEOLOGY.

Lithology.

The Maine building-stones. — It is well known, that, at the time Dr. Hawes was attacked by the illness which terminated so fatally, he was engaged in the microscopic study of the United States building-stones. It has been hoped that some one would be able to take up his unfinished work, and, in justice to his memory, render him credit for all that he had done. Whether this desirable work will ever be accomplished is a problem for the future. Meanwhile, the Maine building-stones collected for Dr. Hawes's work have been the subject of a recent paper by Mr. G. P. Merrill. These rocks, together with much data relating to their use, etc., were collected by Mr. J. E. Wolff, now of the Northern transcontinental survey.

Mr. Merrill classes these building-stones under biotite granite, biotite muscovite granite, hornblende granite, hornblende biotite granite, biotite gneiss, biotite muscovite gneiss, diabase, olivine diabase, and argillite or slate. Of the eighty-three quarries in Maine in 1880–82, seventy-four are of granite or gneiss.

The granites vary in color from a light to dark gray, and from a light pink to red. In texture they vary from fine, even-grained rocks, to coarsely granular ones, containing orthoclase crystals an inch or more in length.

The constituents are quartz, orthoclase, plagioclase, biotite, or hornblende, with or without muscovite, apatite, magnetite, zircon, epidote, sphene, rutile microcline, and iron pyrites.

The paper is accompanied by descriptions of the microscopic characters of the granites, which are of value to all interested either in lithology or building-stones.

The gneisses are similar to the granite, and, so far as the present writer's observations have gone, they are of the same origin.

Diabase, under the name of black granite, is quarried at three localities in Maine, — Indian River in Addison, Addison Point, and Vinalhaven. The first locality produces a nearly black rock composed of plagioclase, augite, magnetite, apatite, and secondary hornblende and mica. The other localities produce a similar rock, with the addition of olivine and chlorite.

It is a remarkable freak of fashion which renders rocks of such undesirable composition so much sought for, and extensively used, for polished monumental and ornamental work used out of doors, for which they are entirely unfit. This well illustrates the wide-spread ignorance, even among architects, of the properties of building-stones, even if New York and Boston, coupled with Harvard university, did not furnish striking examples.

Mr. Merrill's remarks on the properties of building-stones need to be received with caution, especially

those regarding some of the red granites of Maine; for he has probably never seen them after their polished surfaces have been long exposed to the weather. — (*Proc. U. S. nat. mus.*, vi. 165.) M. E. W. [481

MINERALOGY.

Cassiterite. — W. P. Blake notes the occurrence of cassiterite as stream-deposit, as well as in place in the Black Hills, Dakota. It occurs in a coarse crystalline granite, yielding sheets of mica of commercial value, and large cleavage blocks of felspar. In addition, spodumene is found abundantly in gigantic crystals. — (*Amer. journ. sc.*, Sept.) S. L. P. [482

Lithiophilite. — Two analyses of this manganese variety of triphilite are given by S. L. Penfield, — one from a new locality in Norway, Me.; the other from Branchville, Conn. The analyses fully substantiate the formula of the species $LiMnPO_4$, in which a part of the manganese has been replaced by iron. — (*Amer. journ. sc.*, Sept.) S. L. P. [483

Augite. — The calculation of several augite analyses is given by C. Doelter, in which he shows, that in addition to the usual meta-silicate, $R''_2Si_2O_6$, the alumina and alkali, when present in various amounts, are united in molecules of the general formula, $R''R'''_2SiO_6$, of which he recognizes the following distinct molecules, which are isomorphous with each other and with the meta-silicate $R''_2Si_2O_6$: —

$MgAl_2SiO_6$	$MgFe'''_2SiO_6$
$Fe''Al_2SiO_6$	$Fe''Fe'''_2SiO_6$
$CaAl_2SiO_6$	$CaFe'''_2SiO_6$
$Na_2Al_2SiO_6$	$Na_2Fe'''_2SiO_6$

(*Min. petr. mitth.*, v. 224.) S. L. P. [484

BOTANY.

Hybridization of Zea. — Dr. Sturtevant writes, concerning the supposed direct manifestation of hybridization in the fruit of the first year, "We have as yet no station data whereby this belief can be verified." — (*Rep. N.Y. exper. stat.*, i. 1883.) W. T. [485

Fed and unfed sundews. — Büsgen briefly reviews the experimental efforts thus far made to determine the value of animal food for carnivorous plants, and gives the results of some feeding-experiments with Drosera rotundifolia carried on by himself at Strassburg.

To avoid the inequality certain to exist in plants gathered from their native habitat, containing unequal quantities of reserve material, and of different ages, Büsgen used seedlings, arguing that the slight weight (.02 mgm.) of the seed, and especially of its nutrient contents, renders the dry weight of all plants essentially equal at the beginning of the experiment. By averaging the results obtained from many plants, individual peculiarities could be eliminated for the most part; and, by subjecting the seedlings to fluid-cultures with different fluids, the necessity of nitrogenous compounds in the water absorbed by the roots was susceptible of determination.

All of these possibilities were not realized in the experiments reported, which extended through two seasons, since comparatively few plants were experimented upon, and these were cultivated on cakes of peat of unknown composition, saturated with the culture-fluid used. The results were measured by the size and vigor of the grown plants, their fruitfulness, and, finally, the dry weight of all their parts.

Without giving the details of the experiments, — which, though not perfect, appear to be the most satisfactory yet performed, — we may state that they seem to show quite conclusively that plants of this species, properly fed with animal matter (aphides) through their leaves, are individually stronger, more fruitful, and of greater weight, than those subjected to the same conditions but unfed; thus corroborating the conclusions of Francis Darwin, Rees and Kellermann and v. Raumer. It seems, however, as if the organic nitrogen cannot wholly replace that derived normally through the roots, but appears as useful for the plant only when supported by a certain quantity of nitrogenous salts (cf. Liebig, 'Die chem. in ihrer anwend. auf agric. u. physiol.,' i. 436). — (*Bot. zeitung*, nos. 35, 36.) W. T. [486

ZOÖLOGY.

Animal chlorophyll. — Th. W. Engelmann maintains that the diffuse green observed by him in certain Vorticellas is genuine chlorophyll, and not due to the presence of any vegetable matter. The species was found near Utrecht, and is related to V. campanula. The green coloring is diffuse, but is restricted to the ectoplasm. To study it, Engelmann employed the bacteria method, and found that the bacteria accumulated about the animalcule; whence he concludes that the green produces oxygen. Examined with the microspectroscope, the activity of the green Vorticella, as measured by the gathering of bacteria about it, varies in the same way, according to the wave-length of the light in which the animal lies, as does the activity of vegetable chlorophyll under corresponding circumstances. From these and other observations, Engelmann deduces the existence of true living chlorophyll, not of vegetable origin in this protozoon. The article is a contribution to the controversy concerning the existence at all of animal chlorophyll. [Engelmann relies upon the distribution of bacteria in the field of the microscope as a test for the distribution of oxygen. It is obviously hazardous to assign to living organisms whose peculiarities are most imperfectly known the value of a specific chemical test. We must look upon the 'bacteria method' with suspicion, because the idea, which is very ingenious, does not rest upon an established certainty. (*Rep.*)] — (*Pflüger's arch. physiol.*, xxxii. 80.) C. S. M. [487

Morphology of the primitive streak. — Repiachoff has confused the primitive mouth (urmund) with the blastopore. Owing to this, he attempts to disprove the connection of the primitive streak and groove with the primitive mouth by insisting upon the well-established point, that the blastopore is connected only with the posterior end of the primitive groove, overlooking the fact that the blastopore corresponds only to the posterior part of the primitive mouth, the edges of which unite all the way in front of the blastopore to make the primitive streak and

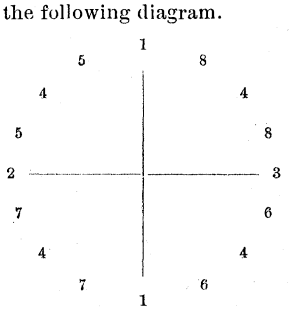
groove, if the latter is present. There appears to be a wide-spread difficulty in comprehending the concrescence of the edges of the primitive mouth to form the axis of the vertebrate body. — (*Zool. anz.*, vi. 365.) C. S. M. [488

Coelenterates.

The life-history of American medusae. — Although Turritopsis is one of our most interesting hydromedusae, its metamorphosis has been entirely unknown. Brooks has added to McCrady's graphic description of the adult an account of the larva and of the changes through which the young medusa passes. The larva is very similar to Tubiclava Allman; and the medusa buds are carried upon short stems which grow out from the main stem, just below the hydranth. When set free, the medusa has eight tentacles and a short simple proboscis; but the endoderm-cells of the radial canals soon become thickened to form the great cellular peduncle, which is the most characteristic mark of the genus. Adult specimens of Turritopsis often contain the singular Cunina larvae which were discovered in this situation by McCrady.

Nemopsis Bachei is another very common medusa, the young stages of which have hitherto escaped observation. Brooks has reared it from a Bouganvilleia, and has traced the metamorphosis of the medusa.

Phortis gibbosa McCr. has been reared from a very singular campanularian hydroid which was washed ashore in great abundance at Fort Macon, on denuded Aglaophenia stems. Only one medusa escapes at a time, and this soon becomes larger than the entire gonotheca. The order in which the tentacles appear is shown in the following diagram.



The larva of Amphinema apicatum Haeckel is a Perigonomus, which grows upon the sand-tubes of Sabellaria. When set free, the medusa has no trace of the apical process, which is an adult feature, although it has usually been regarded as a larval characteristic. When five days old, the medusa begins to assume the adult form: the apical process is developed, the umbrella becomes like that of the adult, the oral folds appear, and the upper end of the proboscis becomes enlarged. — (*Stud. biol. lab. Johns Hopk. univ.*, ii. 465.) W. K. B. [489

Mollusks.

Extramarine mollusca of New Guinea. — Tapparone Canefri has undertaken a general work on the mollusca of New Guinea, of which the first part has just appeared in the shape of a fine octavo volume of three hundred pages and eleven plates. In proof-reading, typography, and illustrations, it presents a marked and favorable contrast to many Italian scientific publications. The second volume will contain the marine mollusks: the others find a place here. From such a region many novelties might be expected. The author, however, is conservative; and the divisions newly proposed are not numerous, though a considerable number of new species are described and illustrated. Bellardiella (Martensiana) from Port Dorey is a Pupinella in which the peristomal sulcus is replaced by a tube posteriorly directed, behind the lip. Sulcobasis and Cristigibba are sections of Helix, typified by H. sulcosa Pfr. and H. tortilabia Less. respectively. Cyclotropis (papuana) differs from Assiminea by its perforated base. Physastra resembles a thick-shelled reversed Limnaea with a dehiscent epidermis. We doubt if it should be referred to the Physidae. Lastly, the section Microdontia is proposed as a section of Unionidae for U. anodontaeformis, in which the anterior cardinal teeth are thin, compressed, and nearly parallel with the margin.

Besides full descriptions or synonymy of species, the work contains useful tables showing the exact distribution of each species and group of species, as far as known, and also dissections of the generative organs, and illustrations of the dentition of a number of species. The work will also appear as volume xix. of the Annals of the Museo civico of Genoa, and is provided with a good index. — W. H. D. [490

Structure of the oyster-shell. — Observations by Osborne show that the shell is formed by the crystallization of lime in the conchioline (not, as stated, chitinous) layer, as is generally believed. The structure of other species was found less easy of investigation; and the complexity of structure in many molluscan shells would indicate that the process of formation is not universally the same. — (*Stud. biol. lab. Johns Hopk. univ.*, ii. 4.) W. H. D. [491

Slime-spinning by Arion hortensis. — Mr. Roeback, having received a specimen an inch long, observed it crawling on a flat paper-knife, from which it projected in a horizontal position into the air, with only the end of its tail touching the knife. Emitting a thread of slime, it hung by it to a distance of four inches; and when, on reaching a support, the thread was severed, it immediately shrank into a minute, scarcely visible point of slime. — (*Journ. conch.*, July, 1883.) W. H. D. [492

Insects.

Distribution of the occident ant. — Rev. Dr. H. C. McCook made a communication on the geographical distribution of the occident ant, Pogonomyrmex occidentalis. The specimens upon which the communication was based were collected by Prof. J. E. Todd in Dakota. He reports that the species is confined to the bottom-lands along the Missouri River, and has not pushed eastward through the territory. This corresponds remarkably with Dr. McCook's conclusion, both from his own observations and those made under his direction by Dr. Horace Griffith of

Marengo, Io., that this ant does not dwell east of the Missouri River, in Missouri, Iowa, and Minnesota; that it avoids eastern while abounding in western Nebraska; and that it is not found in Kansas farther east than Brookville, which is near the site reported by Prof. Todd. The structure of the ant-hills, and the harvesting habits of the species, were described. Mr. T. Meehan, to whom had been referred a small quantity of the *débris* collected from one of the nests by Prof. Todd, reported that there were no seeds among the pebbles, but that there were a number of calices, or undeveloped capsules, of a leguminous plant, Dalea alopecuroides, which is common on the plains. Dr. McCook had been puzzled to explain why such intelligent creatures should be detected in harvesting immature seeds, until, upon inquiry, he found that leguminous plants have a succession of flowers; so that there may be mature seeds and flowers on a plant at the same time. It is evident that the ants were not harvesting out of season, but were occasionally deceived, and cast out to the refuse-heap the calices that contained no edible seed. — (*Acad. nat. sc. Philad.; meeting* Nov. 21, 1883.) [493

Dipterous maggots in man. — Dr. Samuel Lockwood exhibited a full-grown dipterous larva taken from the inner ear of a man at Paterson, N.J., Aug. 30. There was a perforation of the membrana tympani. The man had suffered seven days from its presence. The grub had entered the outer ear, but eluded an attempt to extract it by re-entering the drum. Appearing again in the external ear, it was extracted with forceps, and kept alive for several days. He referred to certain papers read to the society (one in 1880, and a sequel in 1881), in which he described specimens of dipterous larvae passed by a man in large numbers, and which he determined to be larvae of Sarcophaga carnaria and Anthomyia canicularis, which had come of eating tainted cold meat and cold boiled cabbage. He had also shown a larva, which he could not determine, which had been vomited by a girl. The larva taken from the man's ear he had determined to be the viviparous flesh-fly, Sarcophaga carnaria, and thought that the man had eaten meat on which were the freshly laid larvae, which, being very small, might easily be unperceived. If the man had coughed during the eating, he might have thus thrown one of the larvæ against the entrance to the eustachian tube, and it could readily ascend the epithelial walls, feeding upon the mucus on its way. The larva had attained full growth, and, about to pupate, was restless to find a nidus: hence the good fortune of its twice entering the outer ear from the rent in the tympanum. Dr. A. V. N. Baldwin remarked that he had recently found a cluster of grubs, hard-packed, in the external ear of a man in Bellevue hospital; to which Dr. Lockwood replied, "Probably the parent fly had oviposited there when the man was asleep, attracted by the fetid odor of a diseased ear." — (*N. Jers. micr. soc.; meeting* Nov. 19.) [494

Spinning-habit of Psocus. — Rev. H. C. McCook announced that the small neuropterous insect, Psocus sexpunctatus, had recently been found, for the first time in America as far as he was informed, on the Wissahickon Creek, Fairmount Park, Philadelphia, by Mr. S. F. Aaron. The family of the Psocidae is of peculiar interest in being the only true insects which spin webs in the imago state. The generally larval function of web-spinning might, perhaps, be correlated with the rank which zoölogists assign the Neuroptera as the lowest in the order Insecta. It is, however, a striking example of the diverging and independent lines along which life-forms have sprung up in nature, that a function which belongs to the larval stage of insects, and which appears in the imago stage only in the lowest type of the same, should appear as the most permanent and characteristic function of the spider, — an animal, which, although it is now commonly given a lower place in the same subkingdom with the insect, is certainly very differently and but little less highly organized. It would be a difficult task to trace, or even imagine, any evolutionary connection between the web-spinning spider, the web-spinning lepidopterous larva, and the web-spinning neuropterous imago. There is, indeed, the common factor, the spinning-function; but the physiologist fails to perceive any use or combination of the same which can unite the organisms in which it inheres. — (*Acad. nat. sc. Philad.; meeting* Nov. 27.) [495

VERTEBRATES.

Action of the respiratory movements on circulation. — Taljanzeff states, that, in violent breathing, partial or complete inhibition of the contractions of the right side of the heart may take place, without, however, any fall of arterial pressure resulting; the blood being forced from the right to the left side of the heart by the action of the breathing-movements on the heart, especially on the right ventricle. He has discovered, also, that if the branches of the vagus going to the lungs are cut, and their central ends stimulated, a decided reflex action on the heart and blood-vessels is obtained. In most cases the heart was slowed, giving the well-known 'vagus pulse,' and the blood-pressure lowered; though in one experiment there was a fall of aortic pressure without any change in either the force or rate of the heart contractions. — (*Centralbl. med. wiss.*, 1883, 401.) W. H. H. [496

Vaso-motor nerves of the leg. — In a brief preliminary communication, Bowditch and Warren give some of the results of an investigation upon the vaso-motors of the extremities. Their method of determining the contraction or dilatation of the blood-vessels was to enclose the limb in a plethysmograph, — a method undoubtedly very delicate and accurate, but possessing the disadvantage that it gives only the general result of the stimulation of the nerve on the blood-vessels of the limb as a whole, and furnishes no indication of local dilatations or constrictions which may take place. They find that stimulation of the peripheral end of the divided sciatic may cause either constriction or dilatation. When the induction-shocks followed in rapid succession (16 to 64 in a second), a constriction of the blood-vessels was the general result. When the stimuli followed more slowly (4 - 0.2 in a second), a dilatation was

produced. With a medium rapidity of stimulation, a contraction was observed in the beginning, followed by a dilatation. The latent period of vaso-constriction was estimated at 1.5″; that of vaso-dilatation, at 3.5″. The vaso-dilator effects continued for some time after the cessation of the stimulus. — (*Centr.-blatt. med. wiss.*, 1883, 513.) W. H. H. [497

Mammals.

Birth of a mandrill in captivity. — A mandrill was born in the Hamburg zoölogical garden in July, 1882. It lacked the brilliant coloring of the face characteristic of the adult, and had but weakly developed face-wrinkles. The countenance and posterior callosities were flesh-colored. Only the upper and posterior portion of the head and a space on the median line of the back were dark. — (*Zool. garten*, xxiv. 1883, 235.) F. W. T. [498

The circulation in the kidneys. — This paper by Cohnheim and Roy furnishes an extremely important and interesting addition to our knowledge of the physiology of the kidney, and will undoubtedly, with the future work that is promised on the subject, throw much light also on the etiology of some of the diseases of that organ. The method which they employed in their investigation cannot be thoroughly understood without reference to the plates which accompany the article. It is sufficient to say that the organ was enclosed in a sort of plethysmograph, to which Roy has given the name of oncometer, by means of which variations in volume of the kidney can be registered. With regard to the normal circulation in the kidneys, it was found that both the respiratory and pulse waves were shown in the kidney tracing, as well as the Traube-Hering waves, when these occurred.

Stimulation of the vaso-motor centre directly by means of dyspnoea, as well as stimulation of the central end of sensory nerves, caused a strong and rapid diminution in volume of the kidney, owing to the contraction of its vessels. This diminution in volume occurs when both splanchnics are cut; but in those cases in which they succeeded in severing the kidney from all external nervous influences, the kidney, instead of contracting, showed an increase in volume corresponding to the general rise of blood-pressure.

The influence of the splanchnics on the kidney circulation was especially studied. Section of the splanchnics caused no increase in the volume of the kidney, so that the tonic influence which these nerves have been supposed to exert on the kidney-vessels is rendered very doubtful, though the authors do not care to make any positive statement with regard to this point. Stimulation of either the central or peripheral end of the divided splanchnics gave a strong diminution in volume of the kidney. The fact, that, after section of both splanchnics, stimulation of the central end of a sensory nerve still causes a contraction of the kidney, shows that vaso-motor nerves pass to this organ by some other path. In order to cut off the kidney from all external nervous connection, it was necessary to divide not only the nerve-trunks in the hilus, but also to destroy the external coat (tunica adventitia) of the blood-vessels. In cases in which this was successfully accomplished, they could obtain no distinct evidence of a vaso-motor tonus of the kidney-vessels. Stimulation of the nerves of the hilus showed the presence only of vaso-constrictor and sensory nerves: in no case did they obtain any evidence of vaso-dilator nerves.

The circulations in the two organs are, to a great extent, independent of each other. Clamping the renal artery on one side has no effect at all on the circulation in the other kidney, and the same may be said with regard to the closure of other large arteries of the body. Throwing ice-cold water, or water heated to 50° C., on the whole of the skin surface of the animal, has little or no effect on the kidney circulation; a fact which seems to indicate that the direct connection between the functions of the skin and the kidney is not so close as has been supposed. A future paper on the influence of the composition of the blood on the circulation in the kidney is promised. — (*Virchow's archiv*, xcii. 424.) W. H. H. [499

ANTHROPOLOGY.

Ethnology of Yunnan and the Shan country. — Mr. Colquhoun has traversed the region lying between Canton and Rangoon, including Yunnan, the south-western province of China. The details of his exploration have been published in the *Proc. roy. geogr. soc.*, Dec., 1882, in a volume entitled 'Across Chrysee,' or will appear in a work now preparing on the Shan country. From Canton westward the people were pure Chinese; west of that, to the Yunnan frontier, the people were mixed on the rivers; and aboriginal races were found inland. Throughout Yunnan the chief population consisted of Shans disguised under a great variety of tribal names. Lolo and Miao-tzu, aborigines and Thibetans under the name of Kutsung, were seen. Mr. Keane, commenting upon this paper, said that amongst the Yunnan tribes were the widely dispersed Lolo people, who seem to extend in isolated groups from Szechuen, Kwei-chew, and Yunnan, down to the Tonquin highlands, and who by some travellers had been described as physically more like Europeans than Indo-Chinese. — (*Journ. anthrop. inst.*, xiii. 3.) J. W. P. [500

North-eastern Papua. — During a period of six years, 1875–81, Mr. Wilfred Powell made frequent visits to the eastern coast of New Guinea. Torres Straits has become famous as a pearl-fishing ground, worked by fleets of large boats built for the purpose, and manned by natives from all parts of Polynesia. The most fever-cursed portion of the island is the low alluvial plain skirting the Gulf of Papua, opposite Queensland. Here is found the only cannibalism known to the author to exist on the island. The whole of the population here are of a lower type than those in the more elevated districts to the east. At Brumer Islands the two races meet and intermingle, — the darker and more barbarous type of the Gulf of Papua and the south-west coast, and the lighter colored and better featured type, more resembling the Polynesian, inhabiting the south-east and the eastern peninsula. The last-mentioned people are numerous

and industrious. The women are respected, and irrigation is carried on by means of bamboo pipes joined with gum. Obsidian is used for many purposes, such as shaving their heads and faces, carving wood, etc. — (*Proc. roy. geogr. soc.*, Sept.) J. W. P. [501

The Masai people in East Africa. — Zanzibar is now a commercial centre, dominated over by British interests and British trade. It is therefore a matter of great importance to establish an expeditious caravan route over the range in which are Mounts Kilimanjaro and Kenia to Lake Victoria. In the way of this route are the Masai, a tribe reputed to be savage and aggressive. Last autumn Mr. J. T. Last, a physician missionary, made a journey to the Masai country, and reports much that is interesting to the ethnologist as well as to the geographer. The Masai seem to belong to the great Galla race. The extent of their country is very large. The majority are of average height, and the women are about as tall as the men. There is a marked difference in features between the pure and the mixed Masai, the former being of a much higher type. The author describes the scanty dress of the men, one article of which is the *olding'ori*, a heart-shaped piece of goat-skin, serving more for a seat than covering. The women are completely clothed and extravagantly ornamented. There is no iron in their country, nor do they know how to work it. Their domestic animals, weapons, mythology, burials, marriage, crimes, polygamy, and modes of building are all fully described, and a copious vocabulary closes the paper. — (*Ibid.*) J. W. P. [502

Serpent venom. — The destruction of human life by the bites of poisonous serpents is so great in many countries, that it becomes really an anthropological problem to ascertain the amount of damage, and to seek the remedy. Dr. Robert Fletcher has brought together much information, and a great deal of the literature, in a paper read before the Washington philosophical society in May last. Sir Joseph Fayrer states the average mortality from serpent-bites in India to be fully 20,000 annually. In 1869 the returns were obtained through official sources, from a large part of India, with unusual care and accuracy. In a population of nearly 121,000,000, representing an area of less than half the peninsula of Hindostan, the deaths were 11,416, or nearly one in 10,000. Of these deaths, there were caused by

Cobra	2,690
Krait (Bungarus ceruleus)	359
Other snakes	839
Unknown snakes	6,922
No details	606
	11,416

In 1880, 212,776 poisonous snakes were killed and paid for; and in 1881, 254,968.

Even in Europe the number of accidents from snake-bite is very large. In one department of France, La Haute-Marne, the government paid, in six years, for the destruction of 17,415 vipers. — (*Amer. journ. med. sc.*, July.) J. W. P. [503

Mythologic parallels. — Gaidoz, commenting the tendency to trace the myths and folk-tales of Europe to the Aryans on the high plateaus of India, remarks, "that we cannot rest upon those eminences, but must prolong our inquiry over the whole earth: they are not Aryan, they are human." The discussion of resemblances in culture seems to land us ever in a double corner between the supposition that humanity reproduces ever the same phenomena under the same conditions, and the theory that similarity proves contact of some kind. M. Gaidoz cites two very interesting but far remote similarities. Among the ancient Romans, driving a nail was a religious practice, oft resorted to as a remedy against certain maladies, or a preservative against enchantments. Numerous references to this practice will be found under the word 'clavus,' by M. Siglio, in his 'Dictionnaire des antiquités grecques et latines,' p. 1240–1242; and in the chapter upon the nail in the *cella* of the temple of Jupiter, in Preller's 'Roemische mythologie,' 2d ed., p. 231. The law demanded that the rite (*clavi figendi causa*) should be performed by one high in authority, and, in cases of great public calamity, by the dictator himself. Now pass beyond the Pillars of Hercules to the mouth of the Kongo River, and listen to the words of Charles de Rouvre (*Bull. soc. géogr.*, Oct., 1880, p. 323): "Finally there are the *n'doké* fetishes, under the care of priests called *gangazambi*, who are reputed to have the power to cause to speak. An offering is made to the *n'doké* of one or more pieces of cloth and tafia. A nail is then driven into the image, while the *ganga* or the suppliant formulates his demand." 'The barbarians are older than we,' said Plato; and this form of nail-driving into the heart of the image, in order that our prayer may pierce the heart of the god, is much older than the Roman custom. M. Gaidoz further connects this custom with votives on oratorios, on trees, on church-walls, etc., for many purposes. In conclusion, the author insists that the beliefs of classic antiquity are to be studied not only in ancient texts, but in a past far more remote. — (*Rev. hist. relig.*, vii. 5.) J. W. P. [504

Hypertrichosis. — The development of hair on abnormal parts of the body has received the names Hypertrichosis universalis when it occurs over the whole body, and H. partialis when only over limited portions or in patches. The abnormality may be the period of development, in which case it would be heterochronic. It may be sex, as the beard of certain females, where it would be heterogenic. In the first case mentioned above it is heterotopic. Dr. J. G. Garson of London has collected photographs of distinguished cases of hypertrichosis, and states his conclusions as follows: "As to the cause of abnormal hair-growth, the atavistic theory seems to me to be the most probable explanation, as here we would not have to trace the atavus far back, and in the normal body we have the atavistic germ present, though in a rudimentary condition. It would, therefore, be what Gegenbauer terms a paleogenetic form of atavism. — (*Journ. anthrop. inst.*, xiii. 6.) J. W. P. [505

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Geological survey.

Geology. — According to Prof. L. C. Johnson, who has been at work on the geology of Alabama (in the southern part of the state), the tertiary boundary will have to be moved from six to ten miles north of the limits usually assigned it on the maps. The lignitic, a sub-Claiborne division of the tertiary, will therefore appear much extended northward (ten miles at Allenton, six at Camden, and seventeen at Butler Springs). Professor Johnson has collections of fossils to prove his position. He has also recently investigated the boundary-line between the rotten-limestone group and the Eutaw group of the cretaceous, and between the latter and the older formations, and has made large and interesting collections of mammalian and saurian remains from the southern part of Alabama, principally from Autauga county.

Prof. R. D. Irving, who is devoting his attention to the copper-bearing rocks of Lake Superior, reports, that, in connection with Professor Winchell, he has personally examined the quartzites of Nicollet and Cottonwood counties, Minn. One hundred and forty thin sections of rocks have been made, mostly of Huronian quartzites; and more than half of these have been examined, with the result of proving that the quartzites of the original or typical Huronian of Lake Huron, and of the Huronian regions of Marquette and the Menominee River in Michigan and Wisconsin, are fragmental rocks, and that they have never undergone any metamorphism other than that involved in the deposit of interstitial quartz among the clastic grains, of which they are in the main composed. Professor Irving has also begun a comparative study of the greenstones, cherts and flints, and jaspery iron ores of the various Huronian regions examined by him.

Prof. T. C. Chamberlin, who has charge of the morainic investigations in the eastern United States, has recently examined the border of the later drift, principally in Indiana, and subordinately in Ohio, and has completed the tracing of the line from the Scioto to the Wabash, and more fully demonstrated the peculiar association of the remarkable bowlder-belts of those states with morainic aggregations. Prof. J. E. Todd, one of Professor Chamberlin's assistants, has determined more exactly the character of the morainic loop in the vicinity of Alexandria, in southern Dakota. He also found in that neighborhood an exposure of the Sioux quartzite with glacial striae, the direction of which is in harmony with the previous observations. Professor Todd also examined the drift-bluffs in the vicinity of the Big Sioux River, where the loess comes in contact with the drift. In October, Mr. R. D. Salisbury, who is also assisting Professor Chamberlin, made a detailed and specific study of the border of the driftless area in Wisconsin, Minnesota, and Iowa. This had heretofore been examined only cursorily by various observers; and Mr. Salisbury made a critical and connected examination, which developed some interesting points, one of which is to give the outline a form more in harmony with the moraines of the later epoch that lie opposite it on either hand.

Chemistry. — Mr. Hillebrand, the chemist in charge of the field-laboratory at Denver, has been investigating the so-called basic sulphates from Leadville. They are an important constituent of the ore deposits of that region, and occur as a rule under the ore bodies, seeming to be a product of secondary decomposition of the original sulphuretted ores. They appear to be a mixture of the mineral jarosite and basic sulphate of iron with hydrated arseniate of iron, anglesite, and pyromorphite.

A short time ago Prof. F. W. Clarke, chief chemist of the survey, visited and examined the Gilmore mica-mine in Montgomery county, Md., about twelve miles north of Washington, and found it of remarkable mineralogical interest.

Publications. — A few advance copies of the third annual report have been issued without the complete set of illustrations. Besides the report of the director and the various administrative reports, it contains the following papers: Birds with teeth, by Prof. O. C. Marsh; The copper-bearing rocks of Lake Superior, by Roland D. Irving; Sketch of the geological history of Lake Lahontan, by Israel C. Russell; Abstract of report on geology of the Eureka district, Nevada, by Arnold Hague; Preliminary paper on the terminal moraine of the second glacial epoch, by Thomas C. Chamberlin; A review of the non-marine fossil Mollusca of North America, by Dr. C. A. White.

A monograph on the geology of the region adjacent to Golden, Col., by Mr. C. Whitman Cross, is almost ready for the printer.

Geographical field-work. — The following notes of the geographic work of the survey during the season of 1883 are furnished by Mr. Henry Gannett, chief geographer.

Appalachian division. — In the southern Appalachians, five topographic and two triangulation parties have been at work during the season, and are now about returning to the office in Washington. Prof. W. C. Kerr has been in charge of the triangulation. The area embraced in the survey was the mountain region of North Carolina, exclusive of that worked in previous years; the northern half of the valley of east Tennessee; the south-western portion of Virginia; and that part of West Virginia lying between the Kanawha and Big Sandy rivers. In addition to the territory thus enumerated, the western part of Maryland, and adjacent portions of West Virginia and Virginia, were surveyed.

The total area thus comprised will be not less than twenty thousand square miles for the season. Work in this region is necessarily difficult and somewhat slow, on account of the scarcity of salient topographical points, the thick growth of timber, and the heavy rainfall. The latter is a fact that is ignored on most of the rain-charts published during the past ten years.

This work will be published on a scale of four miles to the inch, with contours two hundred feet apart vertically.

Massachusetts division. — In July a survey of Massachusetts was begun, under the direction of Prof. H. F. Walling. In this work the triangulation of the coast survey and the old Borden survey, and the topographical work of the past, are being utilized wherever practicable. The maps will be comparatively detailed, as the published scale is to be two miles to the inch. It is hoped that the work may be completed in about two years. Thus far, during the present season, about two thousand miles have been surveyed, work having been begun in the western part of the state, and extended eastward from the high country as cold weather began to come on.

Rocky-mountain division. — Mr. Anton Karl has surveyed part of the Elk Mountains in Colorado, extending the map made by Hayden in 1874, and has also been engaged in re-surveying the Maxwell grant in northern New Mexico for the interior department.

Wingate division. — This division, in charge of Prof. A. H. Thompson, has its headquarters at Fort Wingate, N.M., and has been working in the plateau country, principally in north-eastern Arizona. Field-work was begun early in May, and is now practically finished for the season. One triangulation party and three topographic parties have been at work, and have surveyed twenty-two thousand square miles. The region they covered is one of the most dreary and desolate within the limits of the United States; and, when its arid condition and the difficulties of transportation through it are considered, it will be seen that this division has accomplished a remarkable amount of work.

California division. — Mr. Gilbert Thompson, who is in charge of this division, began work last year in northern California, and completed the survey of about four thousand square miles. This year the work was extended in all directions from Mount Shasta, reaching to the Coast Range on the west, and into the lava-bed country on the east and south-east. This region lies between the parallels 38 and 42, and meridians 121 and 123. Although the atmosphere was smoky a large part of the time, this division has had a successful season.

Division of the Great basin. — The topographic surveys in the Great-basin district have been confined mainly to detailed work for special maps illustrating Mr. G. K. Gilbert's investigations of the lake-basins of this region. The principal work done has been the securing of notes for a map of the drainage area of Mono Lake, and for a number of special maps of ancient moraines.

Yellowstone-park division. — Mr. J. H. Renshawe has just come in from the field. He has been engaged in work for a detailed map of the Yellowstone national park. He began work early in June, and has covered fifteen hundred square miles, making plane-table sketches on a scale of two inches to the mile. He also remeasured, at Bozeman, a base-line laid out by Wheeler's survey in 1877. Mr. Renshawe expanded this base-line last season, but was prevented from remeasuring it then by the weather.

In California Mr. John D. Hoffman has been carrying on the survey of the quicksilver-mines steadily for more than a year.

NOTES AND NEWS.

Last summer, at the Zurich meeting of the standing committee of the International geological congress, Professor Neumayr of the Vienna university presented, by request, a plan for the preparation of a 'Nomenclator palaeontologicus,' to be issued under the auspices of the congress. His project was well received, and only awaits final indorsement at the meeting of the congress next year at Berlin. The scheme contemplates the appointment of an editor-in-chief (for which post no better person than Professor Neumayr himself could be selected); an editing committee, under whose general supervision the work will be carried on; national collaborators, who are to give special assistance in the literature of their own country; and special compilers, to each of whom a particular section of the work will be confided, and who will be placed in special relation with some one member of the editing committee.

The work, when completed, will probably consist of fourteen or more large octavo volumes. The mollusks are expected to require at least two volumes; one each will be given to cryptogams, phanerogams, protozoa, coelenterates, echinoderms, worms and molluscoida, arthropods, and vertebrates; two volumes will be given to a systematic enumerator, and one to an alphabetical register.

The nomenclator proper will consist of citations of all species (the nominal species in special type) published in scientific works, in accordance with recognized rules, with their synonymes; and the citations will include, *a*, the first publication; *b*, later descriptions which have really advanced the paleontological knowledge of the species, particularly such as give for the first time a satisfactory illustration; *c*, the illustrations found in the best known and most widely circulated 'fundamental work.'

Critical notes and newly proposed names will not be admitted, and conventional signs will be avoided. Abbreviations in the citations will be so given as to be readily understood by every one possessing some knowledge of the literature; and, for serial publications, the use of those employed in the Royal society's Catalogue of scientific papers is recommended. The geological horizon and geographical distribution will be indicated, the former according to the scale of the congress. The language employed will be Latin.

The plan, as presented by Professor Neumayr, is excellently conceived, and, if carried out in the same spirit, will be an immense boon to paleontologists. But one minor criticism occurs to us: it seems a pity to perpetuate the awkward abbreviations employed in the Royal society's Catalogue, in which are too frequently violated the two cardinal rules of proper abbreviations, — the preservation of the order of words

in a title, and, in ordinary cases, the abbreviation of words before the vowel of the second syllable. If those in charge of the compilation of that magnificent but exasperatingly incomplete work had but taken counsel of some of their better trained brethren of the Index society, the world would have had more to thank them for. As it is, their shortcomings seem likely to breed perpetual sorrow.

— On the 28th of July, about nine o'clock in the morning, a Mr. Ferry started from Dover to cross the English Channel on a water tricycle. The construction of the machine is well shown in the accompanying illustration, which we take from *La Nature*. It is evident, however, that the displacement must have been much greater than that indicated. Instead of the light wheels of steel, with tires of rubber, of the land vehicle, there are bulky paddle-wheels. The small wheel behind serves as a rudder. Ferry arrived at Calais in less than eight hours. The distance as a bird flies is twenty miles, but on account of the currents the exertion required was considerably increased.

TRICYCLE ON WHICH MR. FERRY CROSSED THE ENGLISH CHANNEL.

— Mr. Boyd Dawkins, who has long been familiar to American archeologists through his cave explorations, and his volume on early man in Britain, discusses in the *North American review* the question of the antiquity of man in our own country. The subject is treated as a portion of one great problem common to the old and the new world, when man lived in the same low stage of culture on both sides of the Atlantic, at a time when the hands of the geological clock pointed to the same hour over the greater part of the world. With reference to the absolute chronology of geological phenomena, the author makes a statement worth preserving: "The present rate of the retrocession of the Falls of Niagara, or of the deposit of Nile mud, or of stalagmite in caverns, or of the accumulation of rocks themselves, or of the movement of glaciers, has been formerly used as a natural chronometer, on the assumption that they have been going on at the same rate throughout the past, and have been warranted never to stop, or to want winding up, or to go faster or slower than at the moment the observer was looking at them." The chronology adopted in the present paper is that of the author's 'Early man in Britain.' In the light of Dawkins's system, Professor Whitney's pliocene man is found wanting. Skulls of Mexican mustangs and modern stone implements are taken from the same layers. The human bones in the auriferous gravels are indistinguishable from those of the red Indians.

With reference to Dr. Abbott's Delaware River finds, the author remarks, "The identity of the implements proves that the river-drift hunter was in the same rude state of civilization in the old and the new world, while the hand of the geological clock pointed to the same hour." This river-drift man was unmistakably a man, and not a 'missing link.'

— From advanced sheets of the Proceedings of the Anthropological society of Washington, Col. F. A. Seely, of the U. S. patent office, publishes a pamphlet entitled 'An inquiry into the origin of invention.' The author is accustomed, day by day, as new claims for patents come before him, to eliminate the successive steps in the classes of machinery until he reaches the fundamental idea. This is the plan pursued in tracing backward the whole subject of invention to its sources in the mind of primitive man. The subject is illustrated, first, by the story of the steam-engine, and then by the examination of the bow and arrow and other implements of the lower races. The author rejects Professor Gaudry's Dryopithecus, and affirms, "Obviously, archeology can find no trace of a remoter age than that of stone; but I mistrust that the thoughtful anthropologist will accept the

evidence of earlier ages, one of which, taking one of its perishable materials as the type of all, we may call the age of wood. Still farther back must lie an age, as indefinite in duration as any, when man existed in his rudest condition, without arts of any kind, except such as he employed in common with lower animals; and this is the true primitive period."

— In the Bulletin of the *Société géogr. de Marseille* for June, Heckel gives new information, with a *résumé* of old, in regard to the African nut known as Kola, or Guru. This seed, which is hardly to be called a nut, has a kernel about two inches in length, somewhat like that of a peanut, with a groove instead of a projecting point at the germinal end. It may be white or red, or both, to the number of four or five, in the same rough brown pod. It is the product of a tree of the family Sterculiacea. The genus has been called Sterculia, Kola, etc., and there are several species or varieties. This nut, or seed, is remarkable on account of containing (beside glucose, tannin, and a bitter principle) caffeine and theobromine in large proportion. Among the African tribes it takes the place of tea and coffee or cocoa, — products of plants belonging to very different groups, but valued for the same essential principle. It has been used from time immemorial, and many singular stories have been current as to its effect upon the system, though little authentic information was at hand.

Kola is gathered twice a year, carefully shelled, and the bare meats are immediately despatched into the interior, carefully wrapped in green leaves to insure them from drying. They have to be carefully picked over every twenty or thirty days, and all defective ones thrown out. It is considered very important that they should be kept fresh and somewhat moist. However, as soon as they begin to shrivel and dry up, the caravan merchants dry them thoroughly in the sun, and pound them to a powder in a mortar. The seeds are worth twenty or thirty cents a pound at the place where gathered, near Sierra Leone; but they rapidly increase in value away from the original market. At Goree a single seed will be sold at six to ten cents, according to the state of the market. In the interior the tribes on the Niger pay as high as one dollar per seed, and in times of scarcity a slave has been given for one seed. In the far interior the Arab merchants frequently dispose of the powder for its weight in gold-dust.

The Kola is the stimulant of the African tribes, and is in order on every occasion. Among those peoples where the nut is not indigenous, nor yet too extravagantly dear, no transaction of any moment can take place without an exchange of Kolas. This is either in token of good will or to 'bind the bargain.'

If two tribes ally themselves, they exchange white Kolas, this color being always the token of good will and peace. If war is declared, the announcement is made by sending red Kolas to the enemy. A request for a wife is accompanied by the present of a white Kola from the lover to the intended mother-in-law. The response favorable is by a seed of the same color; a refusal, by a red one. The wedding present of the husband to his bride is incomplete without a certain proportion of Kolas. In the interior, where they are so valuable, the gift of one is considered a high attention, and, when given by a chief to a white traveller, takes the character of an assurance of protection. One of the chiefs of the upper Niger sent Zweifel and Mousteir red Kolas wrapped in green leaves as a sign that they would not be permitted to ascend certain sacred water-courses included in their programme.

In religious and judicial proceedings they are equally important. All oaths are taken on these seeds: the witness holds his hand over them, swears, and then eats them. An accuser demanding justice brings to the judge a little basket of rice with four or five Kolas upon it. The sorcerers lay great stress on the attractive qualities of this seed in drawing away evil spirits, sickness, and misfortune. Friends place with the dead some Kolas, that he may safely endure his 'long journey;' and, to crown all, the Mahometans declare it to be a fruit of divine origin, brought to earth by the Prophet himself.

The nut is chewed as if it were tobacco; the powder is eaten. The taste is sweet, astringent, and bitter in succession. Europeans as well as negroes are devoted to it. It not only sustains the system under the greatest fatigues, even without food and for long periods, but it is also a certain preventive of the dysenteries and deadly fluxes which render that region so unhealthy. The powder makes foul water drinkable and harmless. The negroes, without sufficient cause, regard it as an aphrodisiac; and for this reason, in Martinique, in the botanical garden, where there is a plant brought from Africa, the director has never been able to save a single seed for propagation.

— Apropos to Professor Leidy's interesting article in No. 43, a correspondent draws our attention to the fact that the botanists have not overlooked the crystals in the bark of forest-trees. See, for example, Gray's Botanical text-book, from second to fifth editions, in which those in the bark of the locust-tree are mentioned, and those of hickory figured.

— Dr. A. Graham Bell has reprinted in pamphlet form, from the 'American annals of the deaf and dumb,' a very interesting account of the method followed by him in teaching a boy, deaf from his birth, to read the written language and to write English himself. The child was five years old when the course of instruction described began, and had received only three weeks' private instruction from the principal of the Boston school for the deaf and dumb. About a year later he was able to write a letter to his mother, which, to be sure, contains many mistakes, and is not always readily intelligible in its sentences, but which yet shows that he could already communicate with others in writing. The author gives specimens of such letters written without assistance. One cannot read these few pages without a strong feeling of admiration for the ingenuity and patience displayed in producing such a result, which shows how much can be done for the early education of the deaf and dumb.

— Mr. Estaban Duque Estrada, a native Cuban, has made an extended investigation of the useful qualities

of the best Cuban woods, with a view to exhibiting the resources of his country in this direction, and to the opening of our markets to his native timber. The research was made in the mechanical laboratory of the department of engineering of the Stevens institute of technology, and included the determination of moduli of resistance in tension, torsion, and compression, as well as for transverse loading. The woods are specified by their Cuban and by their botanical names, and can thus be identified. The first part of the work is now published; and the moduli of elasticity found for forty woods of sixteen distinct species are given, together with a full description of the apparatus, and the methods of test. These moduli are all high, and run very uniformly, usually above two millions. But one (Caoba) falls under a million and a half. The stiffest woods are the Dagame (Colycophyllum candidissimum) and the Jiqui Comun (Bumelia nigra), which have a modulus of two millions and a half.

The woods described are nearly all hard, strong, heavy, highly colored, taking a handsome finish, and excellent for constructive purposes. Some of them are not liable either to decay, or to injury by insects. They seem quite likely, should they become known through Mr. Estrada's work, to prove exceedingly valuable additions to the stock of available woods for the American market; and their introduction is likely to afford a valuable commerce, if it is properly encouraged by our own consular department and the Cuban officials. A full account of this part of the investigation is given in *Van Nostrand's magazine* for November.

— The Johns Hopkins university circular for November announces the resignation of Professor Sylvester from the chair of mathematics, and his early return to Europe. His loss to this country will be keenly felt by our mathematicians, for his presence and activity have given mathematical studies a remarkable stimulus in this country. We notice, in the December number of the *American journal of mathematics*, so long conducted by Professor Sylvester, the name of Dr. Craig given as assistant editor, which we trust indicates that it will be continued by the latter after Professor Sylvester's departure. The Johns Hopkins university has recognized the value of Professor Sylvester's services by electing him *professor emeritus*, and by passing resolutions in which the board of trustees "cordially extend to him its hearty thanks for the invaluable services which he has rendered to the university, and also its profound sense of the great ability, the conscientious fidelity and untiring energy, with which he has discharged the arduous duties of his chair, thereby elevating the science of mathematics to its proper plane, not only in this institution, but in this country."

The circular also announces the acceptance by Dr. Paul Haupt, professor of Assyriology in the University of Göttingen, of a call to the Johns Hopkins university as professor of the Shemitic languages. Dr. Haupt has already commenced his work, and has classes organized in Hebrew, Arabic, Assyrian, Ethiopic, and Sumero-Accadian.

— Killingworth Hedges described to the British association the fire risks of electric lighting, and is thus reported in *Nature*. There is a great difference between the electric currents which have been in constant use for telegraphic purposes and those which are to be supplied by the undertakers under the Electric-lighting act. The latter can be said to be free from danger only when the heat generated by the current is utilized in its right place, and not developed in the conductors or wires which lead the electricity to the incandescent lamps. The Fire-risk committee have already issued rules for guidance of users of electric light. These can hardly be said to embrace all the salient points of the new subject, which can only be arrived at after years of practical work. The necessity of proper regulations has already been recognized by the insurance-offices, both in the United States and Germany; and some of their special rules are given in this paper. The conductors must be properly proportioned for the current they have to carry. Whatever resistance there is in the conductor will cause a corresponding development of heat, which will vary with the amount of electricity passing, and inversely as the sectional area. As the temperature in Dr. Matthiessen's experiments upon the subject was not increased over 100° C., the author has made some further experiments, heating the wires by the electric current from a secondary battery to within a few degrees of their melting-point. Various materials were tried; the wires and foils having such sectional area, and being so arranged, that, on the current being increased by twenty per cent, they were immediately fused. The total length of each experiment was twenty-four hours, during which time the current passing through varied slightly. The results of the experiments were given.

— Mr. Joseph Thacher Clarke is giving a course of three lectures on classical archeology before the Johns Hopkins university, in one of which the recent work at Assos, under his direction, will receive special attention.

— On Nov. 13 the Arlberg tunnel, the third largest not only in Europe but in the world, was opened. It was not exactly the formal opening which took place Nov. 13 (this was celebrated Nov. 20), but the sounding-rod (three metres long) of the powerful boring-machine penetrated from the west side to the east gallery. A mass of rock sixty centimetres thick still separated the two galleries. One gallery was driven from St. Anton, on the Tyrolese side, and the other gallery from Langen in Vorarlberg. Both galleries sloped upward into the mountain; the Tyrolese rising two feet in a thousand, the steeper Vorarlberg fifteen feet in a thousand. When the Tyrolese section had penetrated 4,102 metres, it was continued downwards at the grade of the eastern end, the point of intersection lying nearer the west than the east mouth of the tunnel. As with the St. Gothard tunnel, there was but one mistake in the measurement, the length of the tunnel being three metres less than was computed.

The construction of the tunnel (10,263 metres long was begun June 22, 1880, by hand, and Nov. 13 of

the same year, machines were introduced; so that an opening was made just three years to a day from the first time that the point of the drill, driven by compressed air, was forced into the gneiss of the Arlberg. The laying of the road is to be completed in six months, so that business may be conducted about the middle of May.

The St. Gothard tunnel is 14,900 metres long. The boring in Airolo and Göschenen began in 1873. After seven and a half years' work, the last layer of rocks was broken through Feb. 29, 1880; and June 1, after nine years and a quarter consumed in its construction, the road was opened to commerce. The Mount Cenis tunnel (12,323 metres long) was built in fourteen years and a quarter.

With the completion of the Arlberg tunnel by the union of the Adriatic Sea and Europe's granary, Hungary, a further connection is established with the heart of the continent. The Arlberg road, therefore, has not only for Austria-Hungary, but more especially for Switzerland, great commercial and political significance.

— Dr. H. Newell Martin, of Johns Hopkins university, gave, in November, four lectures on the minds of animals, before the Peabody institute of Baltimore, covering the subjects of instinct and reason, the emotions and moral sense, in animals.

— *La Nature* presents an illustration of the new form of equatorially mounted telescope, lately set up at the observatory of Paris, in which the tube of the instrument is bent at right angles; one portion of it constituting the polar axis of its mounting, and the other moving thus in the plane of the equator. The rays of light from any celestial object are brought to the eye of the observer after reflection from two mirrors, the loss of light from which is said to be inappreciable. This form of mounting does away with the customary dome covering the equatorial; and the observatory may be said to consist of two parts, — the movable one, covering the object-glass end of the telescope; and the fixed part, that in which the observer sits and makes his observations, completely protected against the weather. The new instrument is the most powerful one at the Paris observatory, and was built by MM. Eichens and Gauthier, and the brothers Henry. The form of construction is due to M. Loewy, and it has been built through the liberality of M. Bischoffsheim.

— In a late number of *Naturen*, Dr. Geelmuyden has a paper entitled 'Om Islaendernes gamle kalendere,' or the ancient calendars of the Icelanders, the chief peculiarity of which lay in the regarding of the week as the unit of measurement of time. There was also a year of fifty-two weeks, or three hundred and sixty-four days, as also twelve months of thirty days each; the last of these coming in the summer, and having the *Sumar-auke*, or summer addition of the four extra days. The half-years were called *misseri*, and were more frequently employed as a measurement of time than the full year itself. About the year 1000, when Christianity was introduced into Iceland, the calendar of that nation was modified into a near approximation to the Julian calendar; and early in the year 1700 the new style of reckoning was adopted in Iceland, at the same time with Norway and Denmark.

— The following persons, formerly connected with Johns Hopkins university, have received recent appointments: Edward Barnes, professor of the higher mathematics in the Rose polytechnic institute, Terre Haute, Ind.; William C. Day, professor of chemistry and physics in St. John's college, Annapolis; George S. Ely, professor of mathematics in Buchtel college, Ohio; Kakichi Mitsukuri, professor of zoölogy in the University of Tokio, Japan; William A. Noyes, professor of chemistry in the University of Tennessee; and William T. Sedgwick, assistant professor of biology in the Massachusetts institute of technology, Boston. It is also stated by the *Nation* that Dr. C. S. Hastings has received the appointment to the chair of physics in the Sheffield scientific school of Yale college, New Haven.

— Dr. John Rae writes in the *Athenaeum*, "In the *Athenaeum* of the 28th of July there is an extract from a letter of Capt. H. P. Dawson, to the following effect: 'On inquiry, I find that all the far-off Indians describe stone pyramids or altars on the tops of some of the hills far to the north and east of this, . . . composed of blocks of roughly hewn stone of a size such that the men of these days cannot lift. . . . The Indians look upon these remains with great dread, and will not go near them.' I do sincerely hope that Capt. Dawson may discover something new on these reported monuments of 'roughly hewn stone;' but I fear they will be found to be the well-known work of the Eskimo, who, where the country is hilly and rocky, delight in putting up stones of very considerable size — although not larger than a few men can lift — in all sorts of picturesque forms, especially in the neighborhood of a favorite camping-place. An excellent illustration of these Eskimo constructions may be seen in the narrative of Sir George Back (facing p. 378), describing his descent of the Great Fish River in 1834. The Indians, unless they are in great numbers, have a very wholesome and wide-spread fear of the Eskimo, and therefore have a 'great dread of going near these remains,' thinking they might meet the people who built them."

— Professor William Trelease, of the University of Wisconsin, will give four lectures in January, upon the fertilization of flowers, before the Johns Hopkins university.

— It is stated in *Nature* that the meeting of the Linnean society of London for Dec. 6 was to be exclusively devoted to the reading of a posthumous essay on instinct, by the late Mr. Darwin. The essay was said to be full of important and hitherto unpublished matter with regard to the facts of animal instinct considered in the light of the theory of natural selection; and, as the existence of the essay has only now been divulged, this meeting of the Linnean society must have been of an unusually interesting character.

— Prof. S. P. Langley, of Allegheny observatory, will give six illustrated lectures next February, on the sun and stars, before the Peabody institute of Baltimore.